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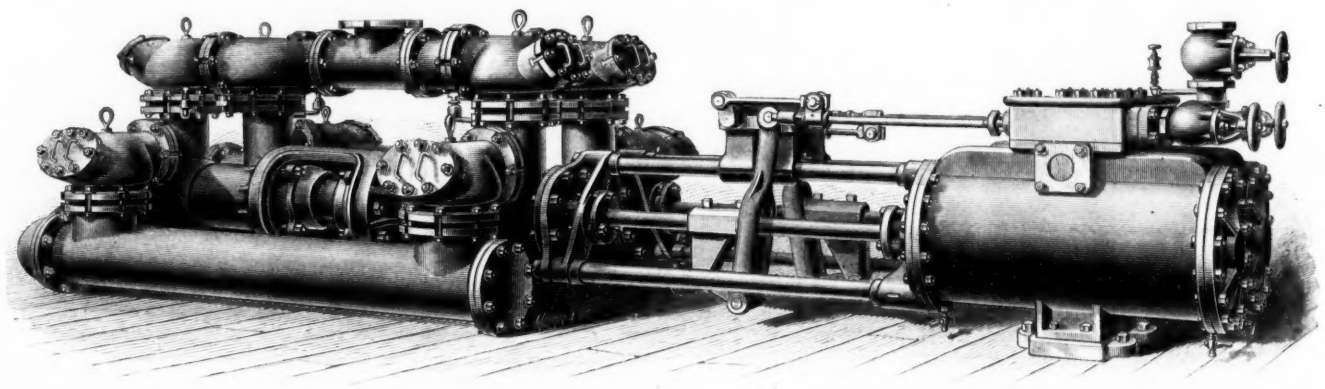
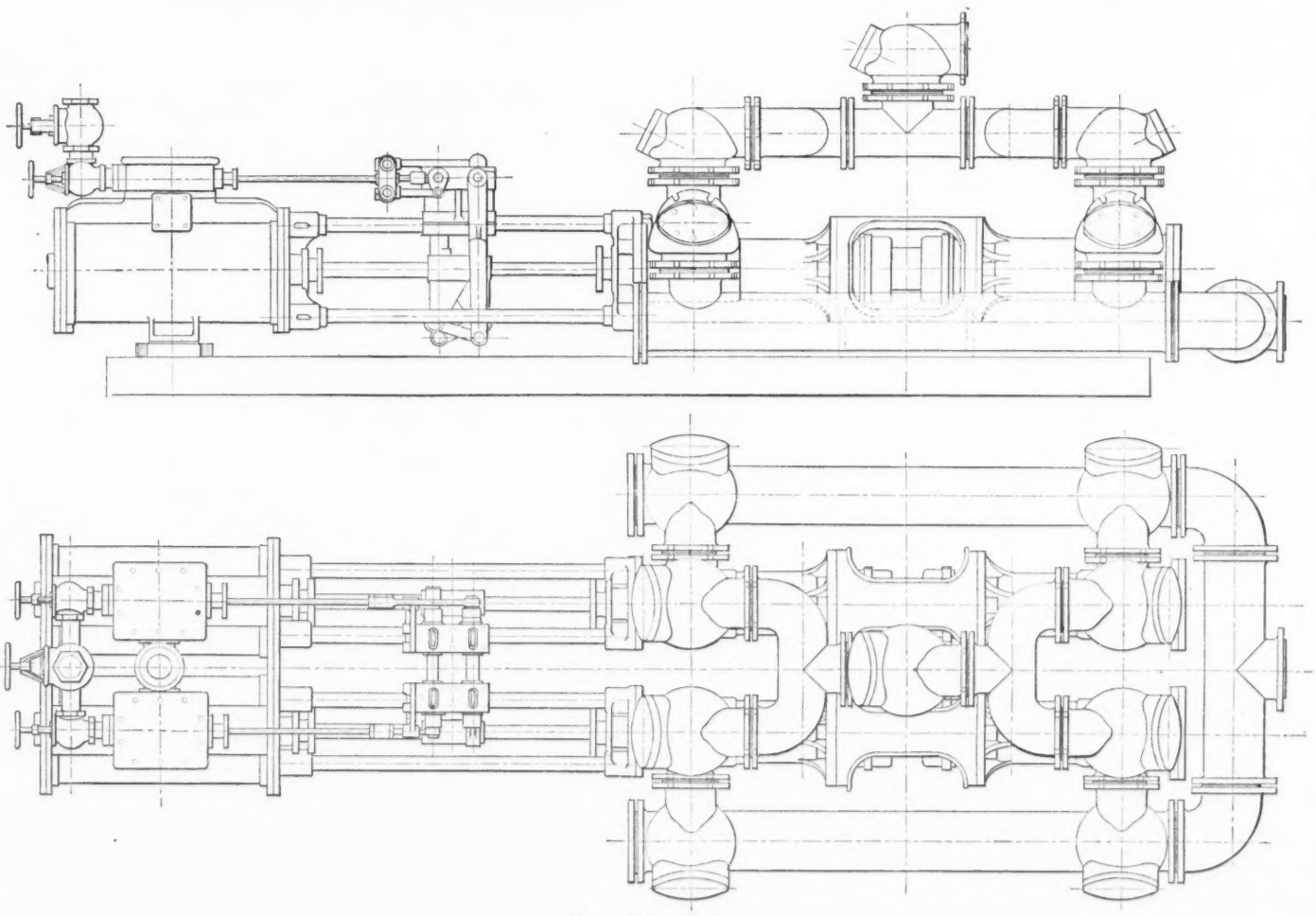
New Mine Pump.

We present, on this and the succeeding page, engravings of a new mine pump which possesses some features of interest, and which has proven very successful among the mines of Pennsylvania, where the pump is manufactured.

The pump from which the illustrations have been made has a steam cylinder 20 inches diameter, 9 inch plunger and 36 inch stroke. It has the Worthington type of valve motion modified to suit the long stroke. All wearing parts, such as rocker-arm pins, rocker-shafts, etc., are made much larger than is the usual practice, in view of the well-known fact that no machinery which is to be used about a mine can be built too strong or have too liberal bearing surfaces.





NEW MINE PUMP.

In constructing the water end of these pumps a center casting or cradle is used, which is extended downwards to form the foot upon which the pump stands. To this are bolted the four pump cylinders in such a way as to make the construction practically as strong and rigid as though all of one casting, while at the same time any one of the four cylinders may be removed and replaced by another without disturbing any of the others.

That part of the piston rods which connects the crossheads to the pump plungers is made of phosphor bronze to resist the action of the acid water usually found in mines. Referring to the detail cuts (page 2), Nos. 1 and 2 show the details of the valve chamber, valve seat and valve. It will be noticed that the valve chamber is of an unusual form, it being the result of considerable experience, and of a study of the peculiar requirements for this service. By this form great strength in proportion to the weight of metal used is secured, with the largest possible clearance around the periphery of the valve without excessive waste room elsewhere, and, finally, a chamber which is simple and easy to fit up, and consequently not troublesome or costly to renew. The point of securing plenty of space about the periphery of the valve is considered to be an important one in a mine pump, and is believed to have much to do with the successful working of these pumps.

The method of securing the seating between the flanges has been used before, but its application to mine pumps has been found to be especially advantageous, as any leak which takes place is instantly detected, and can be stopped before the entire chamber is ruined, as is apt to be the case where the construction is such that a leak may take place without being at once observed.

The area of the opening through the valve seats in this pump is forty square inches, or over sixty per cent. of that of the pump plungers.

The use of a single large valve to each chamber, instead of a multiplicity of small valves, may be criticised, as it is contrary to usual practice; but the makers state that this plan has not been adopted without due consideration, and that it has been found to work with entire satisfaction with their pumps. An instance is cited in which such a pump—14″x10″x36″ single—is regularly making sixty strokes a minute, or 180 feet per minute, with a lift of 140 feet, without air chamber on either discharge or suction. Another single pump—25″x10″x36″—with only two valves to each chamber, is running seventy strokes, or 210 feet per minute, with a lift of 375 feet, and an air chamber on discharge only. And of course so long as such results are continuously obtained without trouble, criticism of methods becomes to a degree superfluous. The valves are of rubber 10″ diameter and 1¼″ thick.

The builders of these pumps are the Jeanesville Iron Works and Machine Shops, Jeanesville, Pa.

The Effect of Water on Red-hot Furnace Crowns.

BY W. H. BOOTH.

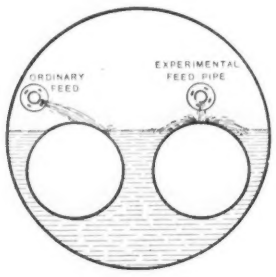
It was long supposed that if a boiler became overheated from the water level falling below the furnace crowns—I refer specially to internal fire-box or flue boilers—an explosion would inevitably ensue from enormous steam pressure, should the feed be turned on and the plates quenched. It is now clearly recognized that the specific heat of iron being only about .2, and the latent heat of steam being large, a very small amount of steam is produced by each pound weight of red-hot plate. In some back issues of the AMERICAN MACHINIST will, I believe, be found a case figured out by me to show how small the effect theoretically is. There are those in this world, however, who are of the persuasion that theory is useless in such a case; they firmly believe that practice alone can show what actually does occur, and they ignore all the data which we possess of specific heats, etc.; as though these were not actual experimentally determined facts.

Such people as this it is that would keep the world still; for nothing could be done upon a basis of previously determined fact. Carried to its logical conclusion, every man using materials in the arts would have to make his own raw materials. The blacksmith, for example, would have to smelt his own iron, so as to be sure he had it.

Well, then, owing to the belief as to the disastrous effects of quenching hot plates in boilers, it was thought necessary by the Steam Users' Association of Manchester (England) to experimentally disprove the fact.

At the time the experiments were made I was personally connected with the associa-

tion, and to some extent, therefore, aware of their *modus operandi*, as also cognizant somewhat of the details. Unbelievers, and they were many, scoffed loudly when it was determined to make actual tests on red-hot furnace crowns in an actual 84-inch boiler.



Many of them argued, and very reasonably, that an unstiffened tube under pressure of steam, would, if it became hot, come down before the rise of water on turning on the feed could quench it. Though the officials of the believing association were fairly certain as to the non-dangerous character of the quenching portion of the experiment, they did not overlook the danger of possible collapse of the red-hot furnaces. For their precautions they were jeered by the unbelievers, who stated openly they would not believe in the genuineness of the association's professions unless all concerned would throughout the experiments chat comfortably together at the boiler front. Of course this was hardly fair, ignoring, as it did, the possibility of collapse before quenching. However, it is an open secret that, though all present were out of the line of fire, there was considerable shaking and trembling in several pairs of shoes, and no little whiteness of gills on the part of even the staunchest professors, and an eye-witness of one of the tests, which did end in a collapsed furnace before the quenching came off, gave a very graphic account of the scene, and described, with much oratorical power and quite a reasonable profusion of adjectives, how the coal flew round, and the fire doors and grate bars rushed forth like shrapnel shot, and the air was filled with darkness and coal dust, and there was great fear upon all the people. The experiments confirmed what all engineers of education and common sense had long known, viz., that a red-hot furnace crown could be prevented from collapse by cooling it so as to stiffen it again ; that, if not soon quenched, a red-hot furnace would collapse ; that it was unsafe to stand in front of a boiler with red-hot furnace crowns ; that red-hot iron in a boiler was no larger reservoir of heat than an equal quantity of equally hot iron in a chemist's laboratory.

All these four things were fully understood before the experiments, and personally, I am disposed to agree with unbelievers that the money could have been better spent; for I do not suppose that men who refuse to credit calculations based on relative specific heats are worth converting by costly experiments.

The chief value of the experiments, to my mind, lies in the fact that quenching the plates did not cause serious ruptures and seam rents, whilst at the time they were made we carried on between believers and unbelievers a discussion in the mechanical papers, of considerable acrimony, and some of us had to have our crowns quenched editorially. For some reason, the experiments were never published, and though often inquired about by engineers, who felt that, after the loud flourish of trumpets which heralded their undertaking, the public ought to have been apprised of the results. Over seven years have gone by, and, after all hope had died, a report has actually appeared, giving a fairly detailed account of the experiments, even to the erratic wandering of a piece of coal which was thrown into the feed tank at the time of the collapse and got into the feed pump in a later experiment. However, to be serious, it has occurred to me that some short account of the tests might be of interest, apart from details of no interest.

The boiler experimented with was 28 feet long by 7 feet diameter, with two 36-inch plain unstrengthened riveted furnaces of $\frac{7}{16}$ plates. The use of such furnaces constituted the first mistake. One furnace at least ought to have been of the modern stiffened description, in order that the different behavior when red-hot could have been shown.

The fire grates were 6 feet long. The water-feed pipes were arranged both as shown on the left and on the right side of the figure. The pipe directly over the flue crown was so arranged, merely for the experiments, so as to secure absolute and sudden quenching of the heated crowns. At some distance to the side of the boiler was erected a sort of bomb-proof structure, which served as a protection for the experimenters, and as a house of observation, into which all gauges were brought and blow-out taps, so that the boiler could be manipulated from this shelter.

Having thus roughly described mode of the tests, something further of interest may be said of them later.

Sketches of an Apprenticeship.

By W. S. Rogers.

X.

The firm having taken a contract to make several thousand malleable iron (or what would be called "steel" in these latter days) hand clamps, an old lathe was rigged up for cutting the screws, and put in a small back room. As the job was taken at quite a low price, the old man decided to put one of the cubs on the job, and the red-headed cub was the lucky one to get on the lathe. He enjoyed it immensely for the first few weeks, but its being the same thing over and over, and being all by himself, he grew rather lonesome and began a systematic sort of laying off on account of "sickness in the family," "having to go to the country," "sprained ankle," etc., until the foreman lost patience, and one morning put the tow-headed cub on the job. Tow-head went into that room several inches taller that morning, and after looking over the pile of screws cut by his predecessor, and examining the cutting tool, he concluded that Reddy didn't know much about the proper way to grind a thread tool and had spoiled lots of work. Now was his opportunity to show his superior knowledge about tool grinding as he had seen the jours do it, so he reground the thread tool, and went in to make a record, taking particular pains that his work was kept separate. Along in the afternoon the old man got around in that room. Tow-head immediately called his attention to Reddy's work. "See that pile, Mr. Smith? All spoiled." The old man examined it, and asked the trouble. "Look at the threads ; that's no way to cut a thread," said Tow-head. "How are you cutting them?" asked the old man, and as he gazed on the pile that Tow-head had cut he acted real mad, and telling the boy that *his* work was all wrong, he hunted up our foreman and read him the riot act for not showing that boy how to cut a "backed-up" thread. Tow-head never knew there could be anything else than a V thread, neither did I, and the old man gave us both a bit of advice together after scoring the foreman, and as we compare notes now it is singular how many times in life we have seen grown-up men, who write M. E. after their names, doing the same foolish things Tow-head did that day, only on different work.

The old man told us to "Never condemn a thing just because we had never seen or heard of such a thing being done. Always to find out the reason first, and comprehend clearly why conditions existed as we might find them, before we began the overthrow of some other man's work. Because you boys will never know everything—no man ever did—and condemning and changing your predecessor's work, through ignorance and to show your own smartness, only illustrates your own lack of knowledge, and *costs the firm lots of money*." "Fools rush in where angels fear to tread."

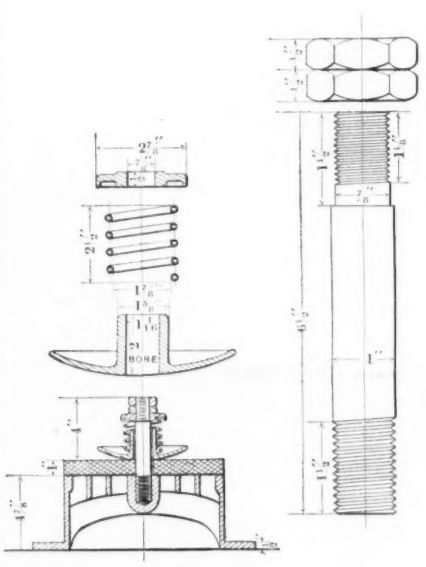


Fig. 2.

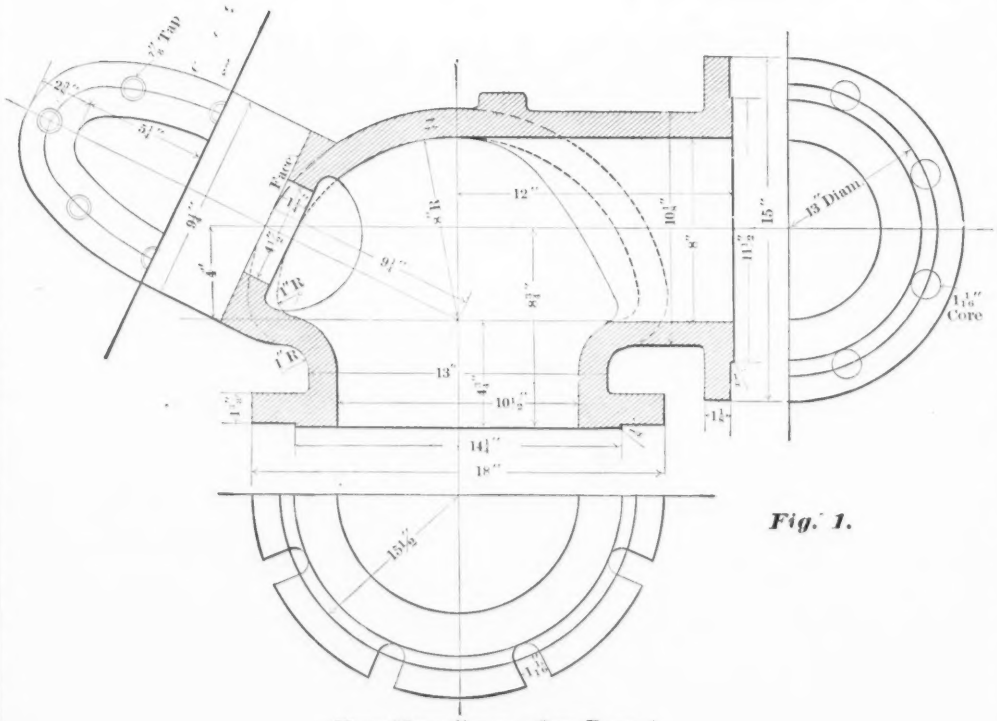


Fig. 1.

NEW MINE PUMP.—SEE PAGE 1.

A Novel Form of Flexible Tubing.

By T. R. Almond, New York City.

(A Paper Presented at the Richmond Meeting of Mechanical Engineers.)

It seemed to me at first rather a wild kind of an idea to make a metallic tube which would be quite flexible, and which could be used for conveying illuminating gas. I have, however, after many experiments, succeeded not only in making a flexible tube for such purposes, but also one which will convey gases, steam, or liquids under considerable pressure. This tube has sufficient flexibility for all practical purposes, with the additional advantages of great strength and durability.

When a tube is formed by coiling a wire around a mandrel, the convolutions may be made to press upon each other with considerable force, and the joint formed at the point of contact of the individual convolutions will be tight in proportion to the amount of pressure exerted. If such a tube be bent, the joints will be broken all around the coils except at one point, and therefore, when bent, it is useless for conveying liquids or gases.

Wishing to utilize the peculiar flexibility of spiral spring tubing for the conveyance of gases in cases where a flexible tube is required, I conceived the idea of interposing a triangular-shaped wire between the coils of a round wire, as shown by Fig. 1 (page 2). When a tube so constructed is bent, the convolutions of the triangular coil adjust themselves to the spaces between the round coils, as shown in Fig. 2. The triangular wire is pressed between the coils of the round wire, during the process of constructing the tube, with sufficient force to spread them apart, so that the contact surfaces are at all times under pressure. The triangular wire serves two purposes—one is to spread the coils apart, so that the pressure will be exerted on the contact surfaces; the other, to fill the irregularly shaped spaces between the coils of round wire, adjusting itself to the changing form of the spaces due to any given flexion. This pressure brings into play the elem ent of friction to such an extent as partly to destroy the flexibility of the tube, which, when bent, will retain the form given to it. This was an unlooked-for and unexpected quality. As the primary object was to obtain a flexible tube, trials were made with wire having a more obtuse angle, such as shown by Fig. 3. This gave better results, as a more perfect joint was produced with less tension of the inner coil, and the friction became correspondingly less, the result being a tight tube with sufficient flexibility. Fig. 4 shows the shape of the seats into which the round wires are forced by their tension. Reference to Fig. 1 will show that the seat for the inner wire is much more obtuse, and on this account the inner wire will not, under a given tension, be forced into such a seat so tightly as in the sharper *V* in Fig. 4. It will be seen that the degree of flexibility depends upon the amount of tension put upon

the inner coil, or the extent to which the convolutions are forced apart. I have produced a perfectly tight tube with two coils of round wire, in which the outer coil is wound sufficiently tight between the convolutions of the inner coil to spread them apart for the purpose of getting pressure on the joints, substantially the same as with the triangular wire. This makes a very strong tube, but is too bulky for many purposes. Two half-round wires, or even less than half-round, may be used; or the inner wire may be round, and the outer half-round, or much less than half-round. The tube will then be less bulky, and, supposing the outer wire to be considerably less than half-round, the convexity of its surface may be such as to give results similar to the obtuse triangular wire shown in Fig. 3. I have made several tubes in which the contact surfaces of the coils are made to coincide with a circle whose center is the axis of the tube. The joints so formed are practically a series of ball and socket joints; such a tube has smoother outer and inner surfaces than those previously described. A serious objection to such a tube is that the wire changes its shape during the process of coiling, so that the joint surfaces will not make sufficiently complete contact, whereas the forms of wire previously mentioned are of simple construction, and the slight change of form which occurs during the process of coiling will not affect the result. The extent to which this tubing may be bent without leakage is considerable; a piece of one-quarter inch bore, tied as shown in Fig. 5, has been subjected to a steam pressure of 75 pounds without leakage; the smallest curves of the bent portion corresponded in this case to a circle two inches in diameter. I have not yet made any tube larger than five-sixteenths inch bore, but think it possible to make them as large as one inch bore, and strong enough to stand any ordinary steam pressure. For purposes where pressure is not required, the tube may be made of sheet metal, shaped as shown in Fig. 6, which may possibly be made as large as two inches in diameter.

The Armored Cruiser "Maine."

The armored steel cruiser "Maine" was successfully launched on the 18th inst., at the Brooklyn Navy Yard. The contract to build her was authorized by an Act of Congress approved August 8, 1888, at a cost not to exceed $2,500,000, and a clause in the act called for her completion by October 3, 1892 Her hull was designed by the Bureau of Construction; her engines and boilers are from designs of the Bureau of Steam Engineering; her guns and other armament are from designs furnished by the Bureau of Ordnance; her materials of construction are the products of American soil, American furnaces and rolling-mills. When it was decided to build the cruiser at the Brooklyn Navy Yard very few facilities were on hand for constructing so large a steel vessel; the small plant available at the time had to be increased, causing considerable delay. The keel was laid in October, 1888, and, considering the difficulties which had to be overcome, the launch of the vessel on the date mentioned reflects credit on the officers in charge of the work. The cruiser "Maine" will be the largest war ship of the American fleet. Her general dimensions are: Length between perpendiculars, 310 feet; breadth, extreme, 57 feet; mean draught, 21½ feet; displacement 6,648 tons; total indicated horsepower, 9,000; speed, 17 knots.

Exactly what the armor will be will not be decided until the completion of the proposed nickel steel experiments. As the matter now stands she is to have a side armor belt 180 feet in length, and 12 inches in thickness. It will be made by the Bethlehem Iron Works, Pa. Her guns are of the most approved pattern. She will have four ten-inch breech-loading rifles, two in each turret. The guns are being built at the Washington Navy Yard. The length of these guns is 329 inches, and the length of bore is 310 inches; they weigh a little over twenty-four tons each, and will be capable of throwing a projectile of 500 pounds with a charge of 250 pounds of powder. The effective range of these guns is about nine miles.

In addition to the ten-inch guns the "Maine" will carry six 6-inch breech-loading rifles. They are mounted in turret-shaped structures. These guns are 196 inches long, take a charge of fifty pounds of powder, and a shell of 100 pounds.

The secondary battery will consist of four Hotchkiss 57 m. m. single shot guns; four 47 m. m. single shot guns; four Hotchkiss 47 m. m. revolving cannons; nine Hotchkiss 37 m. m. revolving cannons; and four Gattlins.

The contract for building the machinery was awarded to the Quintard Iron Works, of New York, at a cost not to exceed $735,000. The work of building the "Maine's" machinery is one of the greatest, if not the greatest, marine engine construction ever attempted in this country. We understand that the Quintard Iron Works was the only firm in the country that made a bid for the work; the magnitude of the work, and the exacting conditions of the specification probably deterred younger concerns from bidding. The contract specifications gave the builders two years and a half to complete the building of the machinery, and one year additional to erect the same in the cruiser. The engines are of the vertical inverted cylinder direct-acting triple expansion type; high-pressure cylinder, 35½ inches diameter; intermediate cylinder, 57 inches; and low-pressure cylinder 88 inches diameter; stroke, 36 inches. There will be eight single-ended steel boilers of the horizontal return flue type, 14 feet 8 inches diameter, and 10 feet long; each boiler has three furnaces, and will carry a pressure of 135 pounds. Total heating surface, 18,800 square feet; grate surface, 553 square feet. The propellers, two in number, are three-bladed and 15 feet diameter.

The vessel will be supplied with its entire outfit of steam pumps of the "Blake" make, including the hydraulic pressure duplex pumps for working the guns, etc., and the independent air and circulating pumps for the main engine. The combined air and circulating pumps will be of the same type as are now in the "Chicago" and "Dolphin" and which have been in successful operation for over six years. The type of this independent air and circulating pumping engine is one having two vertical single-acting air cylinders each 30 inches diameter, in combination with a horizontal double-acting circulating pump of 30 inches diameter, all of which are driven by a compound direct-acting steam engine having a 12-inch diameter high-pressure cylinder and a 24-inch diameter low-pressure cylinder. There are two of the above, one for each propelling engine.

The cruiser will be lighted by electricity; the plant for this purpose consists of four dynamos and engines, and so connected that any one of them is able to supply all the circuits for the incandescent lamps. Three powerful search lights will also be provided for tracing torpedo vessels, etc., or for finding hostile submarine torpedoes, and for navigating tortuous and dark channels. The dynamos will supply power for internal illumination, side lights, head lights, and lights in magazines and bunkers. She will also be fitted with a range finder and other electrical appliances for working the guns as devised by Lieutenant Bradley A. Fiske.

When this vessel and others now under the course of construction are completed, the new navy will consist of seven iron steamers, one first-class torpedo boat, thirteen single-turreted monitors, ten armored vessels, one armored ram, two dynamite cruisers, and twenty steel cruisers or gunboats.

Fig. 1.

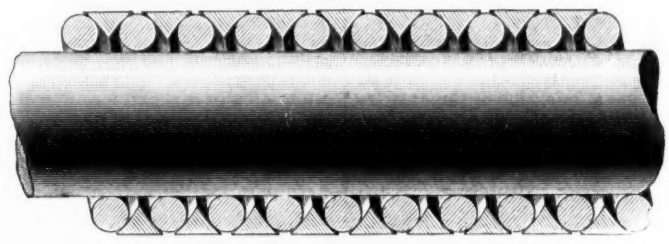


Fig. 2.

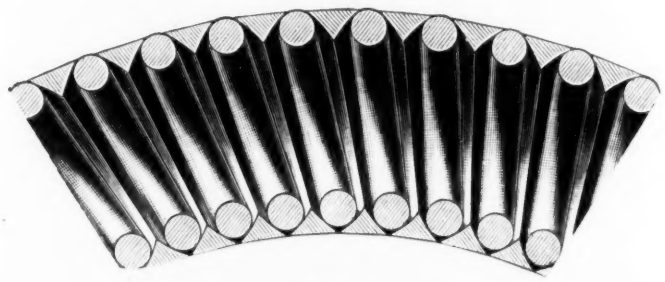


Fig. 6.

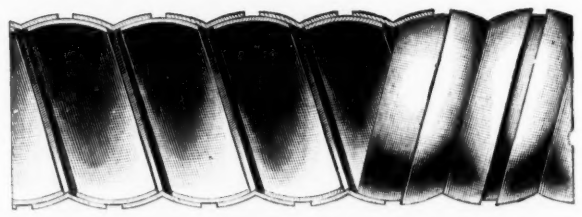


Fig. 4.

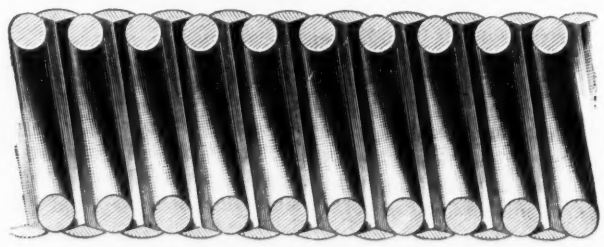
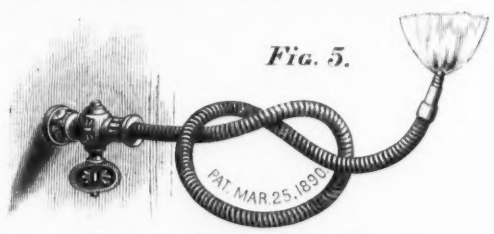


Fig. 3.

Fig. 5.



NOVEL FORM OF FLEXIBLE TUBING.—SEE PAGE 2.

To Prevent Slipping of Belts.

Edwin A. Kimball, instructor in the shops at the University of Illinois, says on this subject: "I do not know that washing soda may not be as good as castor oil, for I never used the former; but I do know that castor oil is effective and safe in the hands of a competent person. There is no occasion to soak a belt in any sort of oil. A little applied to the surface is sufficient. There is nothing that I have ever tried that is so effective as castor oil, especially for woodworking machinery belts. The way to apply it is to let it run from a bottle in a small stream on the belt while this is in motion, commencing at one edge of the belt, moving the stream over a little at every full travel of the belt, until the whole width of the belt has received its portion. I know of belts that have been treated in this way for years, and they are whole yet, and doing their work without a murmur."

The steam from the big buildings along Newspaper Row has been playing a curious prank during the last few days. Instead of being blown away quietly somewhere without troubling persons down in the street, it has been condensing and falling on the heads of those passing, like a very fine rain. It has kept the sidewalk well wetted part of the time, and has caused the putting up of numerous umbrellas, the owners thinking that it was actually raining.

The foregoing from the New York *Times* is something that we have called attention to at various times. There are appliances made especially to overcome the nuisance complained of, and if these appliances are not used, pedestrians must, of course, suffer the consequences.

Most manufacturers like to think and do think that their operations result in decided benefit to the people whom they employ, and generally speaking they have of course good grounds for so thinking; But it is a question if all have, without regard to the wages paid. The weavers in some of the New England cotton mills are said to make scarcely one dollar a day, and whether the proposed extension of such mills so that more weavers will be employed will be a benefit to American labor or not, is a matter of opinion, and our opinion may be recorded in the negative.

On the 24th of last month the apprentices of the Brown & Sharpe Manufacturing Co., to the number of something over 60, went on an excursion from Providence to Boston, to visit the Mechanics' Fair. The company gave the boys the time in which to do this, and special rates and accommodations were secured, so that the trip was of course a very enjoyable one for them, and profitable as well for all concerned.

The international telegraphic rates on the continent will conform after July 1, 1892, with the schedule fixed by the recent international telegraphic conference in Paris. Between Germany and adjoining countries the rate will be 2½ cents per word; between Germany and Great Britain, Scandinavia, or Italy, 3½ cents per word, and between Germany and Russia, Spain or the Balkans, 5 cents per word.

There is a feeling amongst eastern mechanics that western farmers have nothing to do but to put in their crops. The fact is, that the "Great West" is, broadly speaking, anything but a paradise for those who till the soil. Just now, for instance, the farmers of Kansas are selling their farms for money enough to get out of the State with, and railroad companies are sending agents amongst them to secure their patronage.

Shop Notes.

BEAMAN & SMITH.

Beaman & Smith, of Providence, R. I., who will be remembered as the men who several years ago left positions of responsibility with the Brown and Sharpe Mfg. Co., to go into business for themselves, are at present unusually busy, chiefly on specially designed machine tools, which they are making a prominent feature of their business. Considerable business is also being done in their regular line of machine tools, which have been illustrated in our columns from time to time, and the growth of business of both kinds has forced an enlargement of facilities, and an addition to the shop is now just about completed, which will not only give them more room, but by the opportunities which it affords for putting up floor trolleys, etc., better facilities for handling work. The enlargement also gives an opportunity for the extension and rearrangement of their tool-room, which at the time of our visit was going on, and the shop had the air of disorder which is inevitable when changes of that kind are being made.

The character of the work done here calls for no shop methods differing much from the regular thing, the standard machine tools, with milling machines and a B. & S. universal grinder, together with what naturally goes with these things, constituting the equipment.

MILLING MACHINE FOR SWINERTON WHEELS.

On the floor of this shop is to be seen the milling machine which has milled the facets on the Swinerton driving-wheel tires for locomotives. It was designed and built here for the Swinerton Company, and is as much of a novelty in the way of a milling machine as the wheel is in its way. The wheels are milled in pairs, the tire being in place on the wheel centers, and the centers on the axle. Steel rollers are placed in the frame of the machine, which is extended out at the back for that purpose. There are two of these rolls on each side of the machine, and they are quite near the floor, so that the wheels are readily rolled onto them—the distance from one roll to the other being adjustable in order to make wheels of any size come about the right height to be operated upon. The milling is done by end mills, the spindles upon which they are mounted lying in a line radiating from the center of the wheels, and to bring them into this position, the carriages upon which they are mounted have a slide which is curved so that the spindles can be tipped forward or back to bring them into position. By this construction all extended movements of any part of the machine are avoided, the wheel simply resting upon the four rolls in front of the cutter spindles, which are then inclined to make them lie in the radial line. Motion is imparted to them by a single belt which passes over the pulley which drives one spindle, and from thence over tighteners to the pulley at the other side of the machine which drives the other spindle. The spindles can also be set to the required angle for the tread of the wheel, and both heads are fed simultaneously by a shaft which connects the two feed screws by universal joints. The wheels are not indexed by the machine, but must be spaced off by dividers for the number of facets desired, and the marks so made set to a pointer which is fixed to the machine.

A screw which bears against the side of one tire prevents endwise motion of the axle and wheels when being turned. The machine and the work intended to be done by it, being in the nature of an experiment, it was not desired to go into any great expense in the matter, and taking this into account the machine is undoubtedly a very good example of special machine tool designing.

Where special machinery is built to order, as it is here, it is, of course, specially important that a good system be in operation in the making and keeping of drawings and of patterns; for, of course, a much larger share of the total cost of the work turned out is chargeable to these departments than is the case where a number of machines are made from the same drawings and patterns.

We find the pattern shop in this establishment, therefore, well fitted up for the work, and with every convenience, including an improved saw table specially constructed for pattern makers' work, and described in our notes regarding the Mechanics' Fair at Boston It often happens that when a special machine is to be built, some pattern which is on hand will with possibly a little modification answer for the new machine, and on this account it is important that a system shall be in use which shall render any pattern or drawing instantly available for examination or use. For this purpose the main dependence is placed upon a book which is kept in the drafting-room, and in which all drawings are so thoroughly indexed by name of the machine to which they relate, name of the particular part shown by them, symbols, etc., that any one who is in possession of any information whatever regarding a drawing can obtain from this book all the other information regarding it, which it is needful to know, short of an examination of the drawing itself. Mr. Smith's idea is that no system can be formulated, however, which will be the best for all shops, but that systems must be made to fit the shops in which they are to be employed. His works well for him—better, he thinks, than any other with which he is acquainted, but in another shop it might be found wanting in some particulars. In this drafting-room are to be found in use a full set of the gear scales devised by Mr. Smith, and described by "Jarno," in our issue of Oct. 2. It is possible that it would never pay any one to go into the manufacture of these scales for the market, but that it would pay draftsmen who have much to do with gears to make sets of them on paper for their own use, no one can doubt after an examination of them, and seeing how readily they solve problems which arise in machine designing. Jarno's explanation and sketch make the matter plain enough to enable any intelligent draftsman to construct the scales, and it is not likely that any will regret having done so.

Since the enlargement here, the drafting-room is entirely new, and is fitted up with all the modern appliances. An arrangement of the curtains at the windows is specially noticeable, and worthy of imitation in drafting-rooms where it is necessary to control the admission of sunlight. There are two curtains at each window. Each is the full width of the window, but neither by itself can cover the window from top to bottom, though the two together can do so, the two curtains meeting at a point about two-thirds the height of the window. Thus the lower portion of any window may be curtained, while the top is open for the admission of light and air, or *vice versa*. The plan admits of the use of the maximum amount of light, and windows can be open either at top or bottom without the wind blowing the curtains.

BROWN & SHARPE MFG. CO.

Notwithstanding the large additions which have recently been made to the Brown & Sharpe shops, it is easy to see on going through them that still more room could be used to advantage, and this additional room is to be provided as soon as possible by the erection of still another building, which will be the equivalent of a building 56x98 feet, three stories high.

The growth of the demand for universal milling machines is indicated by the long rows of them standing on the floor in process of construction, lots of 100 to 150 at a time being now the regular thing. Universal grinders are also built in very large lots, and to a great extent by specially designed machinery; the ways upon which the platen slides, for instance, being milled upon an exceptionally massive machine designed and built for that work. Some very large cutters are used for such work, some of those used for milling V slides, for instance, being 8½ inches diameter and 3 inches face, and a spiral mill was noticed which was 5¾ inches diameter and 7½ inches face. At each succeeding visit to these shops one notices an increased use of grinding machines for finishing work, many of them made especially for their work. There are none of these that we noticed that will do any job of grinding which cannot be done on their universal machine as built for the market, but it is simply that so much grinding is done here, that it pays rather to have special machines for some certain classes of work. For instance, we noticed a machine specially constructed for face grinding. In this machine the work is held in a chuck which is on a spindle mounted in a fixed head, and there is a platen upon which the wheel is mounted that has a traversing motion at right angles to the work spindle, this motion being automatic and reversed by adjustable dogs, the same as the platen of the regular machine.

For cutting off stock for making milling cutters, the experiment is being tried of sawing it off, instead of doing it in a cutting off lathe, which is the regular practice. A machine is used in which the bar is held rigidly, while a saw that is practically nothing more than a narrow milling cutter is fed automatically through it. It promises to be a success.

SURFACE PLATES—HAND WORK.

There is one department of the work, at least, in which no improvement upon the traditional methods of the machine shop seems to have been devised, and in which there seems small probability of its being done, no matter how many changes may be made in other lines of work, and that is in the making of surface plates, a business which has grown to be one of considerable importance. The master plates to which the others are scraped are beautiful pieces of workmanship, and larger than are usually found in machine shops; their size being 3x5 feet. There are three of these plates, which are frequently compared each with the others, and, if the effect of wear is perceptible, re-fitted.

Some screw machines were noticed in course of construction which differ from those heretofore made in having much more metal in them, the increased width of the turret slide being especially noticeable. These machines have hardened and ground boxes and spindles, which are lapped to an absolute bearing after being put in place in the head. Some of the machines which stood on the floor with the spindles in place without the driving cones gave a good opportunity for "feeling" the work, and the spindles were found to have that peculiarly smooth and soft movement characteristic of such bearings, and which, so far as we know, is not attained by any other. A significant fact in this connection is that the final finishing on this job is done by skilled hand labor. Another triumph of manual skill is shown by Superintendent Viall with evident pride and satisfaction, and consists of a pair of gauges made by hand out of thin sheet steel in the form of a square, except that instead of coming up to a sharp corner, the corner is rounded to ¼ inch radius. They are male and female, and when laid on a plate of glass and held up to the light, no glimmer can be seen through them, though either gauge be reversed, the straight lines joining into the curves with what appears to be absolute perfection.

BENCH MEASURING MACHINES.

Three new bench measuring machines are being made for use in the shop, the single machine used up to this time being found not to give sufficient gauging facilities. Mr. O. J. Beale is devoting especial attention to these, and it is believed that they are going to be very fine pieces of mechanism. The beds of the machines are made as heavy, and designed with as much care in the distribution of metal as though the machines were to be subjected to the most severe stresses, the object in this case being, of course, to avoid changes by deflection, and variations of temperature. Some scales graduated for these machines under the supervision of Mr. Samuel Darling are beautiful specimens of straight line dividing, the bars, which are of steel about ⅜ inch thick and 8 inches long, having on their upper face three lines of graduations, two of which are easily perceptible, and are to be used for approximate settings, while the third line, in which the greatest possible accuracy has been attempted, is barely perceptible to the naked eye if the eye is a good one. It is to be used in the machine by the aid of microscopes.

BLACKBOARD AND CAMERA.

In the drafting-room the blackboard idea has been adopted, the board being large enough to admit of almost any machine built by the company being drawn on it full size, and pivoted in a frame which can be raised or lowered in slides to any desired height, while the pivots, which are placed at either side, allow the board to be turned so that either surface can be used. A novel application of photography is made in connection with this board. The full size drawing of a proposed machine being made on the board, with dimensions marked in, the drawing is then photographed, the result being a drawing in white lines on black paper, and which may be any desired size, every line made on the board with chalk being faithfully and clearly shown. Mr. Burlingame, who has charge of the drafting-room, showed some drawings which had been made in this way that had been used in the construction of a machine with entire satisfaction. It is safe to say that very few would suspect how they were produced, from an inspection of them.

A CLEAN BLACKSMITH SHOP.

It would be worth the while of any one who always associates the idea of a blacksmith shop with smoke, soot, dirt and disorder, to inspect the blacksmith shop to be seen here. It is as free from these features as is any other part of the establishment, the walls being white, and the windows clean, everything in its place, and a general air of neatness pervading the whole shop. The entire absence of smoke is attributable mainly to the fact that the uptakes from the forges and furnaces lead into the main stack, in which there is sufficient draught to take care of it, and convey it out doors, where it belongs.

MR. SAMUEL DARLING.

The man who is at the head of the firm of Darling, Brown & Sharpe, Mr. Samuel Darling, is now a little over seventy-five years of age. As most of our readers know, he has done very much to develop the skill of the machinist by supplying him with tools that were always equal in workmanship and precision to the best work likely to be done by any mechanic into whose hands they might be placed. He has been one of the leaders in this line of advancement, and there can be no doubt that those who make machinery, or who for any purpose make the exact measurements which seem to be so necessary now in many branches of science, are much indebted to him.

Those who are privileged to talk with him to-day will find, however, that his long service in this line, and his accumulating years, have not lessened his interest in the mechanical problems connected with his line of work, nor his ambition to produce the best work possible. His talk just now is of an enlargement of the business, and of doing much finer and better work than has yet been done. He says he expects to accomplish a great deal within the next five years, and has evidently got his plans laid for doing it. At his age most men begin to lose interest in such matters, and are at least not apt to be found absorbed in plans for new conquests. But when they are so occupied at that age, it simply shows that their life's work has been the one which they could not well help carrying on. It is to be hoped that Mr. Darling's life will be spared to fully develop the plans which he has laid.

A Huntingdon, Pa., dispatch says: At Newton Hamilton, fourteen miles east of this place, a large flow of natural gas was struck on Tuesday evening by the drillers in the new artesian well on the grounds of the Juniata Valley Camp Meeting Association at that point. The well is 600 feet deep, and the gas came out with such force as to throw the water thirty feet high. Great excitement prevails in the vicinity.

A New Forming Lathe.

We give on this page illustrations showing a special lathe intended for the use of manufacturers of brass goods and such other articles as require turning and finishing, to be afterwards plated or not as the nature of the work may require, though it has been used in some instances with good success on malleable iron fittings and is made sufficiently strong and powerful to do any work likely to be required of it.

As will be seen, the foot-stock spindle is moved by a lever to give quick handling for any tool which it may be desired to use there, while the main finishing is done by a forming tool arranged on a slide, as shown at Fig. 2. The tool is held in a vise, which is placed on what resembles the clapper of a planer, the hinge being at the back, while a cam shaft, which passes through under the front end, serves to raise and lower the tool so that it is in place for cutting as it moves forward, but is lowered to clear the work as it moves back, the cam being moved by the lever and tappets shown in the figure at the side of the cross-slide.

This slide may be fitted to any lathe or screw machine having a swing of not less than 16″, and for work which is of such a nature as to require the machine to be stopped for putting in and taking out the pieces answers every purpose.

Where the lathe is furnished complete, however, it is arranged so that the same movement of the lever which gives motion to the tool opens and closes the chuck which holds the work, and the lathe need not be stopped.

In operation, supposing the lathe to be running and the chuck opened ready to receive a piece of work: The work being introduced by one hand, with the other the lever is moved, the first effect of this being to close the chuck. The continued motion of the lever then brings the tool forward to the work, and, as the end of the tool is ground at an angle, it commences to cut at one end of the work and finishes at the other, the piece being then finished ready for plating. The continued motion of the lever then causes the tool to drop so that it clears the work in moving back, the backward motion opening the chuck and restoring the tool to its proper height to operate on the next piece. Where the character of the work makes it advisable, the tool slide is given a movement lengthwise of the bed by the hand-wheel shown, and by this means the tool may be adjusted to work which varies in length. It will be seen that the lathe is of very neat design. It is well built and has been found very satisfactory and efficient by manufacturers of valves, injectors, casket hardware, plated ware, etc.

The lathe swings 18″; work up to 2¼″ (or larger to order) can be formed; the length of bed is 5 feet, and the weight, ready for shipment, 1,050 lbs. It is manufactured by the Meriden Machine Tool Co., Meriden, Conn.

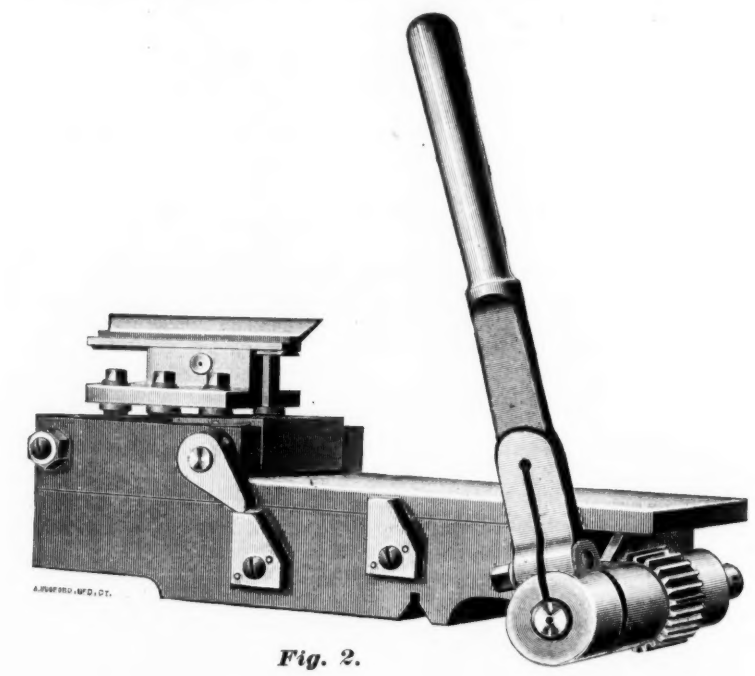
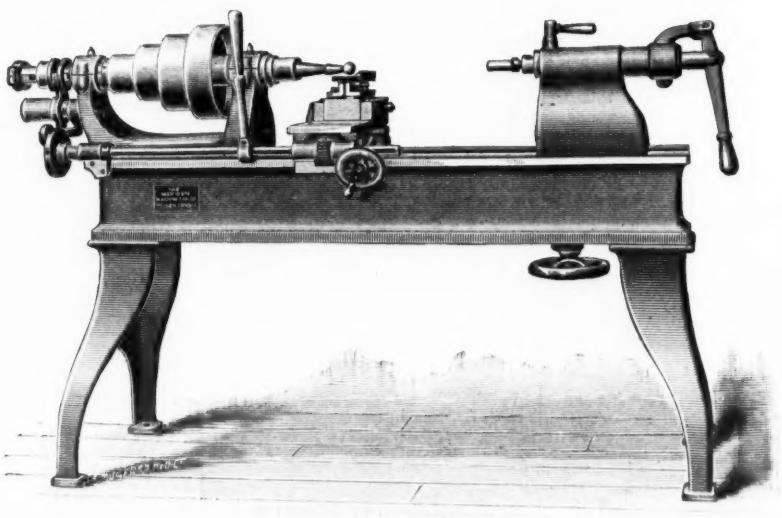


Fig. 2.



A New Forming Lathe.

Richmond Meeting of Mechanical Engineers.

We give herewith a brief review of some of the papers read at this meeting:

AN ENGINEERING PROBLEM IN RICHMOND

was the title of a paper presented by W. H. Adams, of New York. In it he showed how it was possible at comparatively small cost to impound the rainfall and use it in times of low water, so as to get 40,000 horse-power at Richmond. The paper also outlined a plan for making Richmond an inland seaport city through the James River.

LIGHT CABLE ROAD CONSTRUCTION.

This was the title of a paper presented by Frank Van Vleck, of Los Angeles, Cal. The author started out by saying that the main objection raised against cable roads for small cities was the cost of construction, and that it had been said by the advocates of electric traction that cable roads could not be built as a single-track system. This was a mistake, as there were several single-track cable roads, and another would be described in the paper. The author admitted that for level roads the electric system had the advantage, but the cable road would maintain its supremacy where steep grades were to be ascended. He said:

Representatives of the electrical companies have claimed, and even attempted grades ranging up as high as 16 per cent. for their motors, and have repeatedly asserted that when using the return current by the rail the tractive effort is increased by the electric adhesion between rail and wheel. The amount and character of this adhesion has not as yet been as fully explored as the demands of tramway engineers would wish, and with the electrical engineers themselves this feature has not been made as much use of as the merits of the discovery would seem to warrant. Therefore, in the present condition of the system, it would appear unwise to assume that any electric motor car could have any greater capabilities of ascending hills, or for traction, than steam motors with same conditions of weight, wheel base and track.

Then he went on to describe, very minutely, the San Diego cable road. The attempt was made to operate this road by electricity, but resulted in failure, inability to ascend the grades being one of the causes. The paper was very minutely illustrated.

AUTHORITIES ON THE STEAM JACKET, ETC.,

was the subject of a paper presented by R. H. Thurston. Mr. Thurston has got together a mass of opinion on the subject of steam jacketing, the burden of these opinions being that steam jacketing was an advantage. The author thought that it might eventually be shown that steam jacketing, under different conditions, might be either a gain or a loss. [This opinion is, we believe, the one generally entertained by engineers.]

In discussing this paper, J. E. Denton evidently thought there was some personal bias in the matter, but he discussed it with his usual ability, showing that such engines as were shown by Watt to derive benefit from the steam jacket did not exist at the present day. He reasoned that the apparent gains by the steam jacket could be secured by other means, and left the impression that he believed that when gains were shown by the use of the jacket it simply covered up, as it were, deficiencies in other respects. He quoted the chief engineer of the Steamship City of Paris as saying, in effect, that there was no saving in fuel in the use of steam jackets, and cited Mr. Leavitt as saying that when the jacket was broken on one of his engines there was no loss in economy. There was some further discussion, but altogether the paper and the discussion left the hearer in the "don't know" condition in which he has been for the past ten years. Something further is required than mere contradictions of engineers. It is a question by no means settled.

HYDRAULIC TRAVELING CRANES

was put forward by Erwin Graves. He showed the extended use to which cranes had come, and explained the construction of a hydraulic crane of his design, in which all the motions necessary to a traveling crane were made by hydraulic power. The design is quite complete, and shows very fully the system employed.

In discussion, Prof. John E. Sweet submitted the following:

In the hope that the discussion on the above paper may be broadened to a consideration of traveling cranes in general, I am led to describe some novel features we have introduced in a five-ton hand traveling crane of thirty feet span.

To speak of a hand traveling crane may be rather behind the times, but the features described are applicable to power cranes.

The available space between bottom of roof trusses and top of rails was 5 feet 6 inches. And in this space we have a lattice girder bridge with trusses five feet deep, and a trolley with wheels four feet in diameter. This is done by putting the trolley inside the bridge, as has been done in the two 45 ton cranes described in the paper, but we avail ourselves of the well-known advantage possessed by a lattice girder over a plate one, that of a great reduction in weight. The weight of the girder and trolley does not exceed two tons. The lower chord of the trusses, which are of special section (Carnegie 345), forms the rail for the trolley. The trolley is in general design like a bicycle with he large wheels four feet, and small ones 10 or 12 inches, nine-tenths of the load being on the main axle. The bridge is also carried on wheels four feet in diameter, with the flanges on the outside, and the faces of the two coupled wheels turned conical, as is done on car wheels. The wheels are coupled by a gas pipe cross shaft, and two small pinions working in internal gears. There is no squaring device whatever, and we have found no use for one.

A traveling crane is such an improvement on nothing, that it would be a poor one indeed that did not give satisfaction. What pleases us especially in our own is its free action obtained by the large wheels, and no useless mechanism. The lifting device is a simple one-ton triple-geared hoist made by the Yale & Towne Co., with the hoist chain strung over multiplying sheaves. This arrangement is simple; it gives very nearly, if not quite, as great efficiency as any mechanical rig. Its ingenuity will never be over-estimated, and is quite satisfactory. With the largest weight we have to handle, about three tons, one man can handle it, and with one hand easily move it at the rate of 100 feet a minute in either direction. I believe for our use no power crane could equal it in economy.

CHIMNEY DRAUGHT, ETC.

This was the title of a paper presented by R. H. Thurston, the intention being to show what has long been apparent to every-day engineers; viz., that a chimney temperature of about 600° did not represent the greatest effect that could be produced by a chimney in the way of burning coal.

The author, while beyond question showing that the generally accepted theory is wrong, does not give any formula that will give us the truth under all conditions; it is not probable that any mathematical formula can be framed that will cover the variety of conditions existing under different circumstances.

AUTOMATIC REGULATION OF INJECTION WATER TO VAPOR CONDENSERS.

James McBride, the author, showed an automatic device for controlling the quantity of injection water admitted to the condensers of vacuum pans. His device consists of a mercurial thermostat that controls the flow of water by opening or closing the valve in accordance with the temperature of the water discharged.

One of the most interesting papers presented was:

A NEW PROCESS OF CUTTING THE TEETH OF SPUR WHEELS.

This paper was presented by Ambrose Swasey, and was published in full in our issue of Nov. 13. The discussion brought out the fact that the inventor had not seriously thought of putting the machine on the market. It is more than likely, however, that it will be manufactured for sale.

A NOVEL FORM OF FLEXIBLE TUBE.

This paper is presented in this issue of the AMERICAN MACHINIST. We call the attention of our readers to it. It is a remarkable application of well-known principles of friction and tension, that will more than repay any attention that may be given to it.

A number of other interesting papers were presented, to which we may have occasion to make future reference.

TOPICAL DISCUSSIONS.

Time was lacking in which to go through with the interesting list of questions presented. The first question on the list: "Is there any reason why corrosion should be more active in one place rather than another, inside a steam drum, properly piped to several boilers in a battery?" brought out some interesting discussion. Mr. McBride, who it appears propounded the conundrum, illustrated on the blackboard the connection of several boilers with a steam drum. These connections were made in the ordinary way. While there was no corrosion in the boilers the drum was cut through, and the connecting pipes were destroyed. Analysis showed nothing wrong in the water. In discussing this question various opinions were expressed, the most common one being that the current of steam and entrained water cut the metal. But it was shown that the cutting occurred in places remote from any probable action of a current. Theories of galvanic action were set up, and disposed of, but in the end the question remained unsettled.

Increasing the Efficiency of Machine Tools.

BY A MECHANIC.

We have become so accustomed to see one cutting tool to a machine, or at least to a tool block, that when we see any different arrangement we are tempted to stop and look, if from no other motive than one of curiosity.

The remarks I have to offer in this line I suppose will mostly apply to manufacturing.

There are several things to be gained sometimes in using a number of cutting tools.

In the first place, where there is considerable stock to be removed a depth of cut and amount of feed and speed that would be very severe duty for one tool to bear can be taken easily when the work is distributed on two or more tools. A great many times in lathe work, and sometimes in planing, two or more tools can be used to rough out different sizes at one time, and so, after getting the tools set right for one piece, a great many can be done without so much measuring as is usual, and a saving in time affected due to turning several sizes at once. Most machine tools are strong enough, and have belt power enough, but there are a great many reasons now that compel us to work very light on some work, for the reason that either the work or the tool will not bear more. I do not undertake to show ways by which any kind of a job can be worked to better advantage, but to give some suggestions about some things that I have seen in successful use.

When the work is light and springy, recourse is had to steady rests, follow rests and such things. There is a wide field for invention here, and this invention is best made by the workman himself to fit each particular case. I believe from my experience that the workman who is the most ingenious (other things being equal), and who has confidence in his plans and in himself, and who is given some "rope" by his employer, will give the best results in a machine shop.

The man who goes in "ruts," and who only does a job a certain way, because he has been taught to do that way, and never tries to find a better way, is really a "poll parrot," and is not much ahead of an automatic machine.

There is a great deal I believe, in the advice given in the AMERICAN MACHINIST about giving every worker some responsibility.

If a workman can use his own ideas in his work to some extent, he will feel an interest in that work, and that interest will cause him to work better. It will make his day seem shorter. It will give him some pride in what he does, and, in fact, make a good, careful workman out of a careless, indifferent man, under different conditions. We often see shops where the workmen seldom are allowed to use even the smallest ideas of their own. The foreman in such a shop believes that he has got to put in his "oar" in every little detail, and so the workman loses interest. Such a place is only "a one-horse affair" at best.

Fig. 1 shows a plan of a scheme I worked on the tool post of a Pratt & Whitney lathe for roughing off stock. The Pratt & Whitney lathe—as I suppose most of the readers know—has two slots in the tool block. I took advantage of these, as is shown.

As a means of getting off stock on a job that will admit of such a scheme, this will be found a success. We often use two "square-nosed" tools, fastened in the same way, for squaring the two sides of collars and such things at one time.

I have used to advantage two tools set to turn two sizes on lathe spindles, one size being about 8" long, and the other about 5".

I tried to turn another size at the same time by using the slide rest, made to bolt on the wings of the carriage when turning large diameters, but was not successful; for when this rest was used on such a small diameter it overhung so much that it was shaky. I believe a special tool block could be made to accommodate three or more tools for such a job, so that a lathe spindle or some similar thing could be roughed out almost all over by running the length of the longest size. It is customary in some shops to use two or more tools bolted to the tool block, and one or more tools in the extra rest bolted to the carriage for turning and squaring up all the steps on cone pulleys at one time.

This saves lots of time when many such cones are to be turned.

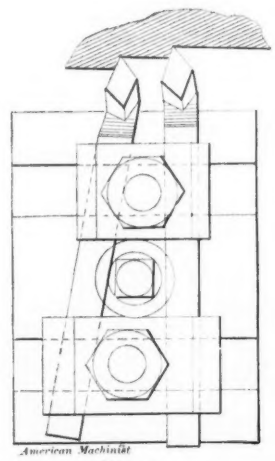


Fig. 1.

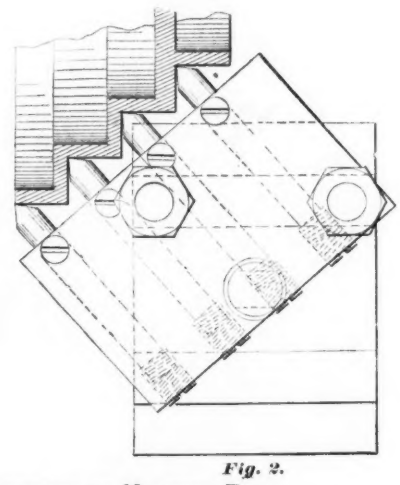


Fig. 2.

INCREASING THE EFFICIENCY OF MACHINE TOOLS.

I show in Fig. 2 an ingenious device got up by a shopmate for turning and squaring up small cone pulleys. It will be seen that all the steps can be turned and squared up, and then, by the use of the taper attachment, all the steps can be turned crowning at one time. The holder was just a piece of cast-iron planed on one side, and the cutters were round steel.

There are thousands of little kinks and schemes now undiscovered that might be drawn out and made good use of if every one in a shop was encouraged to think.

It is a very bad way when a workman shows an interest in his work, and tries to make suggestions to help that work along, to wait a convenient time to discharge that man, with the idea that he is interfering with your business.

There isn't the slightest objection in the world to scientists following up the study of why it is that the little firefly can give out so much light with so small expenditure of energy. When we get reasonably near what nature does, then we get reasonably near what is right.

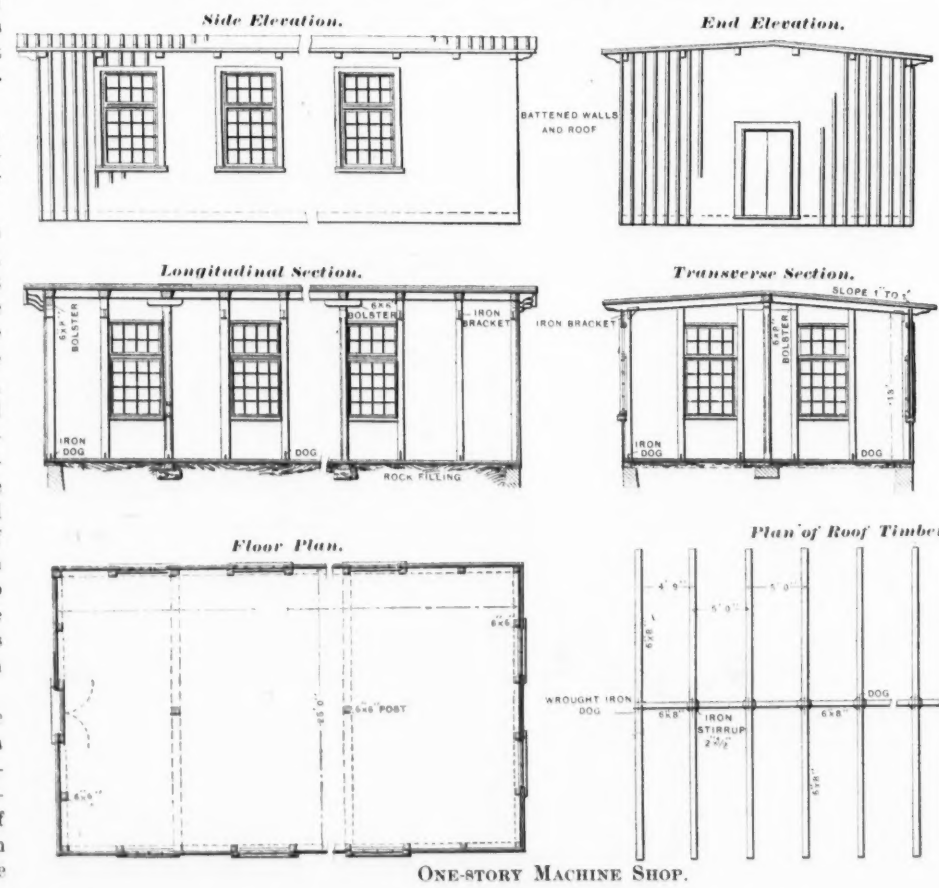
LETTERS FROM PRACTICAL MEN.

One-story Machine Shop.

Editor American Machinist:

A recent number of the AMERICAN MACHINIST contained a request for a cheap one-story machine shop which can be built at a very reasonable cost, and yet serve a useful purpose by reason of warmth and distribution of light. It is proposed to lay the sills directly upon piers or posts, and fill up to grade to the top of the sills with rock filling covered with concrete. The sills are made of 6"x6" upright studding set five feet on centers, and on this is laid two inch spruce plank horizontally, then two thicknesses of tarred paper, and an inch outside boarding laid vertically, the joints being covered with battens.

The roof timbers are 6"x8", secured at the top of the uprights by iron brackets, and hung to a ridge by stirrups of one half by two-inch iron. This ridge is supported at the ends and along the room by a 6"x6" square post every fifteen feet. The roof is of two-inch plank laid across the beams, two thicknesses of tarred paper, and then the top boarding laid at right angles to the plank.



ONE-STORY MACHINE SHOP.

This form of building has no esthetic claims, but merely conforms to the specifications of cheapness and practicability.

C. J. H. WOODBURY.

"Compound Locomotives."

Editor American Machinist:

Your editorial on "Compound Locomotives," in November 13th issue, is, to my mind, without any very reliable data for proof, when you assert that "It is a well-known fact to engineers that economy comes directly from the use of higher steam pressure." Now, if you can furnish any facts to substantiate the above, the writer would be much pleased with them. The high pressure "mania" for simple or "single expansion" locomotives is great, and in the opinion of some a mistake. It is conceded by many that a link motion is not economical when cutting off less than ¼ stroke, which would necessitate the exhaust steam to go to the atmosphere with many "units" of heat where the boiler pressure was 180, and one would suppose that all of the heat that went up through the stack, more than was required for creating a draught, would be a loss; and there are some incidents to uphold this opinion.

The writer knows of a railroad where they have many engines doing fast passenger work, and until a year or two ago the steam carried was from 125 to 135 pounds. Since they have some ten or fifteen new engines with a "Belpair" boiler (otherwise same as former engines), which are now carrying 160 pounds steam, they are on the same runs, and work right in with the former engines, doing the same work, and are run by the same men, and these men are paid a premium on all coal saved. Now if these engines were coal-savers, it is natural to suppose that they would be sought for by men who are looking for "premiums," but up to this date it is not the fact. These engines are noted for being "hard steamers," and not liked as well by many of the engineers as the old engines.

If high steam was such a saving in fuel, why does it not show itself in this case? It has been a subject of inquiry by the writer for years to find out how much saving there was in high steam, but have not as yet found out anything more definite than for some one who had got the "mania" to say that "there was lots," and when you endeavor to find out where and how, they wind up by saying there must be, because there is more expansion in high steam than low. The writer would like to know where there are any facts bearing on this matter; where a fair trial or test has been made.

Now, Mr. Editor, if you have such at hand, you will do a great favor to at least one, and perhaps many more, by just giving them in your valuable paper. All we desire is to have a test that would give satisfaction to not only a body of experts, but also to one that has to pay for the fuel used.

ENGINEER.

Waste in the Machine Shop.

Editor American Machinist:

I wish to reply through the columns of your paper to an article which appeared in the issue dated Nov. 13, 1890. The article in question appeared under the caption of "Waste in the Machine Shop," by Oberlin Smith. After a careful reading of the article three conclusions presented themselves to my mind—viz.: 1st, Mr. Smith is not a mechanic; 2d, if he is a mechanic he is not noted for his progressive thoughts in the machine shop—such as speeding up the lathe and taking a coarse feed when working soft material, and speeding down the lathe and taking a fine cut when working hard material, either of which does away with the wasted time, and saves the proprietor money. Now for conclusion No. 3. If neither of the foregoing conclu-

sions are correct, Mr. Smith must have been educated in a shop where the foreman did the thinking, speed and feed regulating, etc.; of course under such circumstances he is incapable of removing the proper amount of metal in the proper time, and needs a card or a "boss."

I do not wish to antagonize the author's views just for argument's sake. I wish to defend the honest mechanic and raise his thoughts to a higher level by letting him understand that he is something more than a mere attachment to a machine, which the machine builder could not supply. I do not believe that Mr. Smith or anybody else ever saw an honorable and competent workman "killing time" on his machine. When he uses a slow speed and fine feed he has reasons for so doing, and his reasons are certainly entitled to respect and consideration. There are some mechanics who kill time; that I suppose is partly the foreman's fault; they do not receive the proper encouragement in their early training, and perhaps they were the subjects of too much card business, which made them negligent and careless. Don't try to take away from the machinist his liberty in the trade, such as speeding his machine and regulating his feed, and various other liberties, but let's try and give him to understand that we recognize his ability, and if he does not turn out more work than all of the speeding cards that could be printed would force him to do, he is in the wrong pew, and his space in the shop is needed more than his presence.

A few more words and I will close for the present. Suppose all shops would adopt the card system that Mr. Smith speaks of in his most eloquent plea for reform; in nine cases out of ten the card would be useless and cause considerable dissatisfaction, both among the men and employers. Why? Because the employers would insist on having a hand in the making out of the card, and would have too high a speed, and coarse feed for any and every job. Mr. Smith's article was read or "presented at the Indianapolis meeting of the American Association for the Advancement of Science." Now his paper might advance science, and I suppose it did, as it sounds rather scientific. But it is a long way from advancing the cause of mechanics, and Mr. Smith is badly mistaken if he thinks that any such rules are applicable to the intelligent mechanic. I respectfully refer Mr. Smith to "Sketches of an Apprenticeship," by W. S. Rogers, and at a glance he will behold the true method of producing work, and if a glance is not sufficient, let him read the article carefully.

AN OBSERVER.

Editor American Machinist:

I cannot help criticising the article in Nov. 13th issue, entitled "Waste in the Machine Shop," by Oberlin Smith. It seems to me he has not worked many years in the shop, or he would never suggest a posted set of instructions for the guidance of workmen running the tools as to speed and feeds. It is my experience the waste in machine shops is due directly to the employment of incompetent workmen, and all the rules imaginable would never make them anything else.

On the other hand, when well-paid, intelligent men are employed, and have for their foreman a competent mechanic, the waste in the shop is at its minimum, and printed instructions for these would be ridiculous. The man running the machine is always best able to judge the speed and feed necessary to get work out in the shortest space of time. Should a superintendent over me suggest a like set of instructions I would feel tempted to step aside and offer him my machine for ten hours, that he might show his superior knowledge of the business by the amount and quality of work turned out, in excess of mine.

It will never be necessary, in any machine shop where things are conducted right, to have any printed instructions relating either to the work or to the conduct of the men.

By the way, the other day our little shop, the property of and adjoining a large manufacturing concern, had a yellow card tacked up by the general superintendent with instructions for our behavior. After reading it I concluded the firm had a very poor idea of the general intelligence of their machinists. In regard to such rules, the article by T. A. Pandie, in April 17th issue, is to the point, likewise W. S. Rogers, in Sketches of an Apprentice, 13th inst. In short, men possessing an ordinary amount of brains will ever be indignant at such splutter and red tape.

Bay City, Mich. HY. P. HOAG.

What a terrible thing it is, to be sure, this continual and increasing slaughter of men on railroads in this country. It makes one sick to read of it. The government of the United States owes to common decency, the appointment of a commission to inquire into the cause of these increasing railroad accidents. It is getting so that railroad trains are run with less care than ordinary mule teams on a western turnpike. It is come to be a gambling operation as to the safety that shall be provided. It is a betting on the chances of having to pay more for loss of life and wrecks than is saved by parsimonious management—nothing more or less.

Rolling Tubes from Fluid Metal.

In our issue of Aug. 15, 1889, we illustrated a proposed system of rolling rails and other metal shapes, patented by Edwin Norton and J. G. Hodgson. The peculiar feature of this system is that the fluid metal was not permitted to cool before entering the rolls, and that no subsequent heating was required.

With this we illustrate the same general system as it is proposed to apply it to forming hollow shapes, such as pipes of round or other section. As illustrated, the arrangement is represented as to be used for pipe of circular section.

Fig. 1.

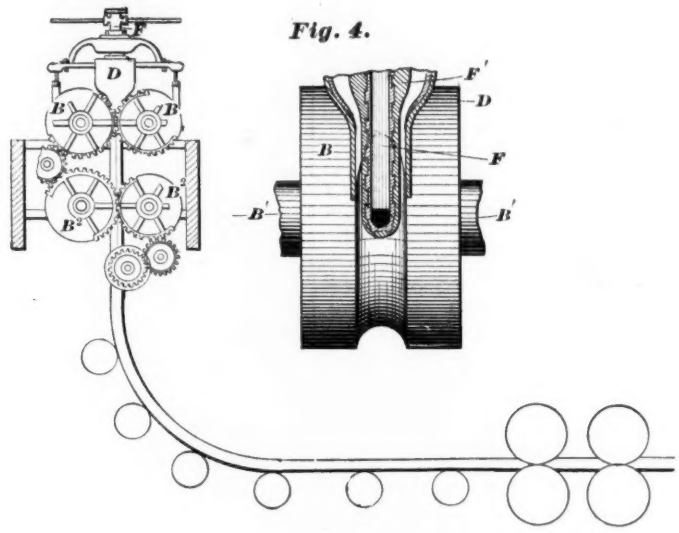


Fig. 4.

Fig. 2.

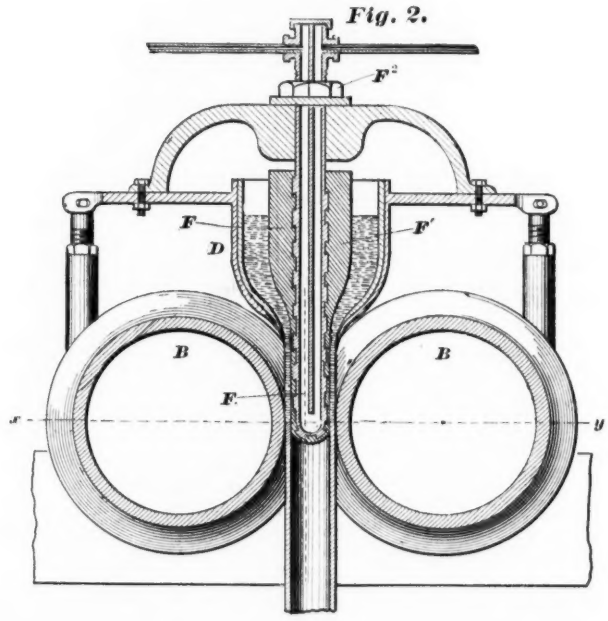
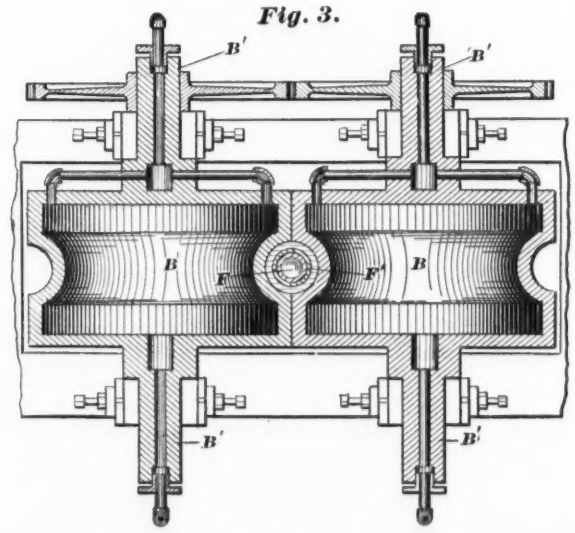


Fig. 3.



ROLLING TUBES FROM FLUID METAL.

Referring to the engravings, Fig. 1 is a side elevation of the proposed machine, Fig. 2 a partial central vertical longitudinal section on line *x—y*, Fig. 3, and Fig. 4 a partial vertical section through Fig. 2. Wherever similar reference letters are used on different figures they denote the same parts.

It will be seen that the molten metal passes down through a suitably formed spout *D*, between the grooved rolls *B*. These rolls revolve in the same direction and at practically the same surface speed as the speed of the entering stream of molten metal. More than one pair of these rolls may be employed if desirable, as shown in Fig. 1.

It will be concluded that the rolls *B* give to the outside of the pipe the proper form and dimension; to give form to the inside, a mandrel *F* is employed.

As, however accurately the forming rolls *B* may be made, it is certain that in practice fins will be formed at their points of contact; to remove these fins special shearing wheels are employed.

The curved and horizontal direction of the pipe after leaving the rolls, as shown in Fig. 1, is given by the use of suitably arranged guide rolls. It is evident that these rolls may be arranged in pairs to continue the rolling process if thought advisable.

Proper arrangements are made, as will be seen by reference to the engravings, for cooling the rolls and mandrel by the admission of water, and for protecting the mandrel by the use of refractory covering. The cooling is for the purpose of protecting the rolls, and setting, or chilling the metal at the proper time.

Other necessary arrangements are shown by the engravings in such a way as to be readily comprehended.

It is claimed for this process of making pipe that it will be practically continuous, enabling pipes of any length to be made; that the pipe thus made, being without welds, will be homogeneous, and hence of superior quality, and that the process of manufacture will be greatly cheapened.

The patentees are Edwin Norton and Edmund Adcock, of Chicago, Ill.

The Spanish Navy.

A decree published in the Spanish official *Gazette* embodies the policy of Admiral Beranger, Minister of Marine, for the reconstruction of the Spanish navy on a practical basis, and some details are cabled by the Madrid correspondent of the *Times*. The minister, whose advanced ideas on naval construction are well known, quotes freely in his preamble from the best known foreign naval authorities of the day, and points out that it is most essential for Spain, under her special conditions, financial and otherwise, to have, first, rapid steaming cruisers instead of more costly heavy armor-clads; secondly, lighter armament and greater uniformity; and, thirdly, interior armoring and protection, as against outside armor belts. In support of this he specially quotes Admiral Mayne, Lord Brassey, and Sir N. Barnaby. The decree provides that, for the future, cruisers, both of the first and second class shall have a minimum speed of twenty knots under natural draught. The minister is opposed to forced draught. In view of the fact that Spain possesses no fortified coaling stations, he proposes that the new vessels shall carry sufficient coal to enable them to steam from 12,000 to 15,000 miles. Admiral Beranger is also in favor of torpedo boats for harbor defense, and is of opinion that their numbers should be largely increased. While recognizing the difficulty of carrying out his scheme, in consequence of the unfortunate condition of the Spanish treasury, which renders impossible the same rapid advancement in naval construction that is made by other nations, he points out the absolute necessity of at once placing the Spanish navy on a sounder footing, and one more consistent with the position of the country as a naval power.—*London Engineering.*

The President in his Thansgiving Day proclamation says that "Bountiful compensation has come to us for the work of our minds and of our hands in every department of human industry." We think there are some departments of human industry in which the truth of this would be disputed, and it may just as well be recognized that such is the fact, though it wouldn't sound well in a Thanksgiving Day proclamation.

The types made us say last week that The Pratt & Whitney Co.'s new shop would be 300 by 450 feet, instead of 300 by 45 feet, as it should have been.

AMERICAN MACHINIST

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J. G. A. MEYER, } Associates.
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Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.

Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

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NEW YORK, NOVEMBER 27, 1890.

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The Machinist and the Specialist.

In last week's issue, "A Mechanic" has a communication on a subject which brings to mind some of the differences between the present and the former methods of managing shops, and the difference in what is required and expected of workmen, resulting from that difference in management.

In the old times, when a machine was being built, about all the work done upon it was done in one room, by men each of whom not only had full opportunities for knowing just what he himself was doing, and was likely to be called upon to do, but just what everybody else was doing as well, and how he was doing it. Everybody had free access to the general drawings, could see just what every part of the machine was for, and the nature of the duty required of it. The best mechanics were allowed to be guided largely, if not entirely, by their own judgment regarding the accuracy required in the making of any given piece, the foreman usually only dictating these points to those not competent to decide them for themselves, and exercising a general supervision. Often there were no detail drawings, but the pieces were made from penciled sketches, with dimensions, or memoranda made from the general drawings by the foreman or the mechanic himself, and everybody who worked on the job had an opportunity to know just what allowances were made in various places about the machine, just how much tighter one fit was than another, and why it was considered advisable to have it so. When the machine stood on the floor completed, each and every mechanic who had had anything to do with it understood it from top to bottom, knew all the "whys and wherefores" connected with it, and usually could build one by himself if called upon to do so—at least this was the case with all the really capable men who cared to know anything about it.

There are shops, of course, in which things still go on in much the same way, and where a machinist who is not an all-round workman has an excellent chance of becoming one, or of seeing the propriety of looking for another job.

But in most of the prominent shops of the present day things are very different. A few men who erect machinery, or who, by reason of superior ability, are consulted by the foreman or superintendent, have opportunities for acquiring a general and comprehensive knowledge of whatever work is going on; but the majority have no such opportunities, and must work from sheets of detail drawings, which show, perhaps, nothing but the particular piece worked upon. There are many things which, as our correspondent says, such drawings do not and never can show. Even supposing the drawing to show the allowable limits of variation of size in each part of the piece, there is still much which should be known by somebody, in order that the piece may be made to the best advantage; something which no draftsman can ever show, even if he knows it himself, which, often, he does not. This is the something which the experienced mechanic knows only when he understands all about the machine to which the piece belongs, and is founded upon his personal judgment and experience. No one else can impart the knowledge to him by drawings or by any other method, for it is a knowledge which can be gained only by personal experience of such a nature as to give opportunities for studying the relation of parts one to the other, and the action of the machine as a whole. It is where such opportunities exist that the real machinist is best developed, and no matter how valuable a man may become without such training, it is quite certain that he would be more valuable with it.

The present plan, of course, has its advantages which are peculiar to itself, and it is necessary that large classes of machinery should be built by it, but the man who simply makes parts of a machine to drawings showing that particular part only, falls far short of the old conception of a machinist, and far short of what is still required when a new machine is to be built, differing entirely from any other, and for which no special tools are available. Such machines are, of course, constantly being built, and in larger numbers than ever before, and it is in the building of such machines that the small, but well-equipped and well-managed shops, will always be able to compete with the largest ones, for the reason that such work as is required to be done on them can be best done by men who are genuine all-round machinists in the best sense of the word—men who, when they do any particular thing upon the machine, know why it should be done, and just what object is to be attained by the doing of it.

The modern plan of the minute subdivision of work, with its detail drawings and special fixtures, has its place, and that place is an important one, but so long as new machines are built, differing from others which precede them, the genuine machinist will have his field of usefulness in which he will be invincible.

The New Gun Lathes.

The advisability of the purchase of such gun lathes by the War Department as were lately contracted for with the Pond Machine Tool Works has been called in question by William Sellers & Co., who claim that the lathes will be unfit for the purpose for which they are to be used.

These are not the lathes which we spoke of some time since as being under way at the Pond Works, but a new lot of seven lathes, similar to them, but somewhat longer. The lathes were designed by the War Department, and all the concerns that put in bids upon them bid upon the basis of those designs, except William Sellers & Co., whose bid was for lathes of their own design, which they guaranteed to do the work required in a satisfactory manner. Their bid was much higher than that of any other concern, and the Pond Works, who bid $30,000 for each lathe, was awarded the contract as the lowest bidder.

It is readily admitted by all who have examined the designs, that the Sellers lathes are capable of doing work which could not be done on those built to the War Department designs, and there is little disposition to find fault with the price asked by them for such lathes. The question then hinges upon whether or not the War Department's design of lathe is suited to the work required to be done. This William Sellers & Co. deny, and to help in deciding the matter, the Secretary of War has called in as experts Mr. Horace See, of this city, and Mr. John Fritz, of the Bethlehem Iron Works.

Mr. See is the well-known engineer who, while connected with Cramp & Sons, designed the machinery for a number of our new naval vessels, and is familiar with heavy machine work and its requirements, while Mr. Fritz, who is the general manager of the Bethlehem Iron Works, has paid much attention to heavy tools, and during the past few years has had a number of exceptionally heavy machine tools constructed by various builders to his own designs, and embodying original ideas designed to make them specially fitted for the heavy work done in that establishment.

We do not understand that the contract will necessarily go to William Sellers & Co., in the event that their point is sustained by the decision, but that if the War Department design is decided to be unsuited to the work, new bids must be asked for on some other design. To make the War Department decide that its own designs, upon which it has asked for and accepted bids, and awarded a contract, are unsuited to the work required to be done, will, of course, be recognized as a good deal of an undertaking, for obvious reasons, and it is, of course, possible that William Sellers & Co. do not entertain any very strong hopes of doing this.

There may, however, be other legitimate objects in calling attention to defects believed to exist in the government designs, and it speaks well for the condition of affairs when a firm of undoubted integrity and standing can compel a hearing, in an attempt to show that mistakes have been made. In dealing with a private concern, this, of course, would be impossible, even if desirable; but where the government is concerned, it is desirable, and we think it a wise provision that makes it also possible.

Of course it is not the fight of the Pond Company, and they probably have no interest in it above the value of the contract to them, whatever that may amount to; but the incident brings prominently forward the whole broad question of the policy of a concern building a machine just as others want it built, and not as the concern building it believe it should be built. For it is not probable that a single one of the concerns who put in bids on the lathes believed the designs to be the best possible ones. Upon such a matter men will always differ. They will also always differ, probably, on the question of the policy of building machinery to other designs not believed by the builder to be the best possible; for, so far as we can see, that is a matter of business policy much more than of ethics, if, indeed, the question of ethics enters into it at all.

Unnecessary Fighting.

Recent press dispatches contain information regarding the formation in Pittsburgh of an organization, the object of which is said to be "to fight labor unions." Considered by itself, we do not think this is a worthy object, or one which will result in good to either the members of the association or the general public.

The right of organization by any body of men whatever who wish to organize, we believe cannot be denied upon any reasonable or just grounds.

The mere act of organizing is one which is entirely innocent, if not commendable; but the acts of organizations may be good or bad, and should be commended or condemned and resisted accordingly. It would be entirely proper for the builders of Pittsburgh to organize for the purpose of dealing with the organizations of their workmen, but the character or manner of this dealing with them should depend entirely upon what were done by the workmen's organizations.

Nothing can be plainer than that two organizations, both vitally interested in the prosperity of the building trades of Pittsburgh, could by mutual action do much to bring about that prosperity, and to perpetuate it, and any agreement which might be entered into by the respective organizations would be much more certainly carried out than could possibly be the case where either one or both sides were unorganized. But, of course, there is little hope for concerted action for mutual benefit where one or both organizations are formed with the avowed object of fighting the other, without regard to the merits of the question upon which the fighting is to be done.

When fighting becomes necessary, then it is proper to fight, and to fight with a vim; but more money is made, and everybody is happier all round when the energy that would be expended in fighting is devoted to harmonious action; and it is worth while to make some concessions occasionally to avoid a fight. Any wrong action by any organization may properly be resisted, but the right of any organization to exist cannot, we think, be successfully denied.

There are trades in which questions arising between employers and employes are settled by a conference of duly chosen representatives of organizations, the one representing the men, and the other the employers. These questions are usually discussed and finally settled much the same as any other business matters are settled, each party to the contract knowing that the other will observe its terms. The plan has been found to work satisfactorily, and is much more rational than forming organizations for the avowed purpose of fighting.

A correspondent writes, in regard to a query a short time since as to chilling a casting: "The mixture of metal cannot be bettered. I would suggest increasing the thickness of the chill; this, I think, will overcome the difficulty, my knowledge coming from experience."

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(443) St. L. S. C., St. Louis, Mo., writes: Please give receipt for bronzing iron. *A.*—Iron castings may be bronzed by thorough cleaning and subsequent immersion in a solution of sulphate of copper, when they acquire a coat of the latter metal. They must then be washed in water.

(444) X. Y., New York, writes: Please let me know what kind of metal the Parrott guns are made of. *A.*—These guns were made of cast-iron, strengthened by shrinking a wrought-iron band over that portion of the body which surrounds the charge. None of these guns have been manufactured since 1865.

(445) P. B., New York, writes: To settle a dispute, please state whether the pressure indicated by the steam gauge is the absolute pressure in the boiler. *A.*—The pressure indicated by the steam gauge is not the absolute pressure; it is the pressure above that of the atmosphere. Consequently the absolute pressure is equal to that indicated by the steam gauge plus about 14.7 pounds.

(446) X. Y.,——asks: With which engine can the best fuel economy be obtained—a single Corliss engine, or a high speed compound of the single valve (to each cylinder) type? Each engine is to develop 100 indicated horse-power, and working with 90 pounds steam pressure and exhausting into the atmosphere. *A.*—For a pressure as low as 90 pounds, with the exhaust discharged into the atmosphere, we prefer the Corliss engine.

(447) G. P. S., Paterson, N. J., writes: I would like to know what degree of success I may expect, or what degree of success your readers have had by the use of formula given in the AMERICAN MACHINIST a few years ago, for making blue prints. I have tried it, but have not been able to make clear prints. *A.*—If you refer to the recipe given in answer to Question 449, in our issue of November 5, 1887, we can say that we have followed it for several years and have had excellent results.

(448) B. B., Cedar Keys, Florida, writes: In reference to Question 392 I see that you make the weight of safety valve ball 94.3 pounds. Is this correct? I think not. I had occasion some days ago to work out a similar problem, and did it in this way: We will take the same dimensions as in Question 392, namely: valve, 4 inches diameter; distance from center of fulcrum to center of valve, 4 inches; center of valve to center of weight, 20 inches, which makes the distance from the fulcrum to the center of ball 24 inches; weight of lever, 12.5 pounds; steam pressure, 50 pounds. Now multiply the area of the valve by the pressure, which gives 628.3 pounds for the total pressure on the valve. From this take half the weight of the lever (that is, the weight at outer end,) multiplied by as many times as the distance from center of fulcrum to center of valve is contained in the length of the lever, which is 6 times, then $6.25 \times 6 = 37.5$. Now take the total pressure on the valve, 628.3, and subtract 37.5, or 628.3—37.5=590.8. Divide this last result by 6 (which is the quotient obtained by dividing the length of the lever by 4) and we obtain 98.46 pounds, which is the weight of the ball. If the weight of the valve and stem is given, take this also from the total pressure on the valve. This rule is very simple, and I think it is correct. If not, why not? Or it may be done in this way: Multiply the total pressure on the valve by the distance from the center of fulcrum to center of valve, from this take the length of lever multiplied by half the weight, and divide the result by length of the lever, thus

$$\frac{628.3 \times 4 - (6.25 \times 24)}{24} = 98.46 \text{ pounds.}$$

A.—Your rule is not correct. For instance, you assume one half the weight of the lever to be applied at the end of the lever. This in itself is correct enough, provided the length of the lever had been given, and provided the cross-section of the lever is uniform throughout. To illustrate: Let the lever be 24 inches long, and let its weight be 12.5 pounds, then according to your rule we obtain $24 \times 6.25 = 150$, which is the moment of the weight of the lever about its fulcrum. According to our rule we multiply the distance from the center of gravity of the lever to the fulcrum by the whole weight of the lever. Now the center of gravity of a lever of uniform cross-section throughout will be in the center of the length, that is at 12 inches from the fulcrum, and therefore the moment will be $12 \times 12.5 = 150$. Here then we see that both rules agree, and both would have been correct provided the given 24 inches had been the length of the lever; but this distance is not the length of the lever, it is the distance from the fulcrum to the center of the ball, or, more correctly speaking, it is the distance from the fulcrum to the center of gravity of the ball. To assume that the lever is 24 inches long is wrong; indeed, according to the data given in the example in Question 392, namely, the center of gravity of the lever is 20 inches from the fulcrum, will make the length of the lever at least 40 inches long if it is of uniform section throughout, and longer if the lever is tapered. This shows that your method is wrong, and the safest and correct way is to work from the center of gravity, as we have stated. Again, you say: "If the weight of the valve and stem is given, take this also from the total pressure on the valve." Here you are also wrong, because the center of gravity of the stem and valve does not move in a vertical line. We cannot see any greater simplicity in your rule than in ours. For instance, you have

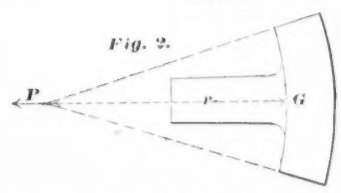
$$\frac{(628.3 \times 4) - (6.25 \times 24)}{24} = 98.46 \text{ pounds.}$$

According to our rule we have,

$$\frac{(628.3 \times 4) - (12.5 \times 20)}{24} = 94.3 \text{ pounds.}$$

Comparing the two it will be seen that one is just as simple as the other, and that your result is wrong. Indeed, we believe it is safe to say that a simpler rule than the one in answer to Question 392 cannot be given. The position of the symbols in the formula need not to be changed for any safety valve problem that may present itself. In all safety valve problems we have the values of all the symbols excepting one given; hence all that is necessary to do is to replace the symbols by their values, and find the value of the remaining symbol by working out the problem as indicated by the signs.

(449) R. B. C., Wilkes-Barre, Pa., writes: Please give strains on arms and rim of fly-wheel of the following dimensions: Area of rim (I section) 30.4 square inches; mean diameter, 13 feet 3½ inches; area of arm (uniform I section) 10.59 square inches; hub to rim, 3 feet; 6 arms; 60 revolutions per minute. *A.*—Let us first assume that the arms exert no tension on the rim, and that the uniform rotation of the fly-wheel depends solely on the tension of the rim; it is required to find the amount of this tension. Fig. 1 shows the half-rim free with two equal tensions P put in at the surfaces exposed. The tension is found by the following formula:



$$2P = m v_a^2 r, \qquad (1)$$

in which P denotes the tension on one section of the rim; m, the mass of one-half the rim, the value of m is found by dividing the weight of one-half the rim by 32.2; thus the weight of one-half the rim is 1,980 pounds, and $\frac{1,980}{32.2} = 61.49$, say 61.5; r is the distance in feet from the center of the wheel to the center of gravity G; this point G is the center of gravity of the semi-circumference $P C P$ drawn through the center of the rim, and it is assumed that the weight of half the rim is concentrated on this semi-circumference $P C P$; the value of r is found by dividing $2R$ by 3.1416; now $2R$ is equal to the mean diameter of the wheel, 13 feet 3½ inches = 13.29 feet, and $\frac{13.29}{3.1416} = 4.23$ feet $= r$; v_a denotes the angular velocity per second; its value is found by multiplying the number of revolutions per second by 6.2832; the number of revolutions is 60 per minute, consequently the number of revolutions per second will be 1; hence the value of v_a is 6.2832. Now, substituting for the symbols in formula (1) their values, we have

$$2P = 61.5 \times 6.2832^2 \times 4.23,$$

and if, for simplicity, we make the square of 6.2832 equal to 39.5, we have

$$2P = 61.5 \times 39.5 \times 4.23 = 10,275.7275,$$

hence, $P = \frac{10,275.7275}{2} = 5,137.8637$ pounds.

The cross-sectional area of the rim is 30.4 square inches, consequently the tension per square inch will be $\frac{5,137.8637}{30.4} = 169$ pounds per square inch. This tension is due to the centrifugal force only; but these sections will also have to support one-half the weight of the rim when it is in its lowest position. One-half the weight of the rim we have found to be 1,980 pounds, and this divided by the sum of the cross-sectional areas of the rim, 60.8 square inches, we have $\frac{1,980}{60.8} = 32.56$ pounds per square inch. Hence the total stress per square inch will be $169 + 32.56 = 201.56$ pounds. To find the tension in the arm, we assume that each segment of the fly-wheel is maintained solely by the tension P in the corresponding arm. Since there are six arms, there will be six segments. Let Fig. 2 represent one of these segments and corresponding arm. Our first step will be to find the center of gravity G of the arm and segment; this center of gravity generally lies on or near the inside of the rim. Since the depth of the rim has not been given, we shall assume that the distance r from the center of the wheel to the center of gravity G is 5.5 feet. The weight of the segment is ⅓ of the weight of one-half the rim, hence the weight of the segment will be $\frac{1,980}{3} = 660$ pounds. The weight of the arm we shall take at 100 pounds, consequently the weight of the arm and segment will be 760 pounds, and the mass will be $\frac{760}{32.2} = 23.6$. The tension is now found by the formula

$$P = m v_a^2 r, \qquad (2)$$

which, as will be noticed, is similar to formula (1); the symbols represent the same data as before. Now, substituting for the symbols their values, and remembering that the value of v_a^2 is the same as before, namely, 39.5, we have

$$P = 23.6 \times 39.5 \times 5.5 = 5,127.1 \text{ pounds.}$$

The cross-sectional area of the arm is 10.59 square inches, and, therefore, the tension per square inch of the arm will be $\frac{5,127.1}{10.59} = 484.1$ pounds. This tension is due to the centrifugal force alone. When the wheel is made in segments, the arm should be so proportioned as to support with perfect safety its weight, and that of the segment when at its lowest position. In the given example, the weight of the arm and segment is 760 pounds, and this divided by the cross-sectional area of the arm, we have

$$\frac{760}{10.59} = 71.7 \text{ pounds per square inch.}$$

This added to 484.1 pounds due to the centrifugal force, we have a total tension of $484.1 + 71.7 = 555.8$ pounds. In reality neither the arms nor the rim sustain the tensions just computed; in computing the stress in the arms we have assumed that there is no stress in the rim, and *vice versa*. The actual stresses are less, and depend on the yielding of the parts. The stresses will also be changed if the wheel has to transmit motion either by belting or gearing. 2. In your issue of September 25, answer to Question 384, you give the tensile strength of cast-iron as 259,200 pounds per square foot, which, divided by 144 square inches, gives 1,654 + pounds per square inch. Is this O. K? *A.*—259,200 is the tensile strength for a factor of safety of 10. The ultimate strength is 2,592,000 pounds per square foot, and this value should have been used in the first equation, but an 0 was accidently dropped; the result, however, in both equations is correct.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Friday morning for the ensuing week's issue.

Lexington Cut Iron Gears. See adv. on p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 155 sold, and all successful. David Bovle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book, mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Universal Vise Chucks. Pedrick & Ayer, Philadelphia, Pa.

Link Planer Attachments. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Audubon Machine Works, New Haven, Conn. Special machinery, heavy and light.

Emery in 10 lb. tins (for machinists' use) a specialty. The Tanite Co., Stroudsburg, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Nov. 20, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N.Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

"Roper's Hand-Books," for engineers and firemen. Send for descriptive catalogue. Address Edward Meeks, publisher, Philadelphia, Pa.

Billings & Spencer Co.'s Packer & Boiler Ratchet, & all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal st., Chicago, Western representative.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Patent Attorney R. G. DuBois, 715 11th street Washington, D. C., procures 1st-class patents for inventors. Send for pamphlet. Guaranteed by Rand, McNally & Co., of Chicago.

Every pattern maker and wood worker should have a Dutton's clipper grinder. No. 5. Send for circular to Montgomery & Co., 105 Fulton street, New York City.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines. T. C. Dill Machine Co., Philadelphia, Pa.

"He who reads—this work—must learn." Aid Collins, Inspector. See, also, extended notice, AMERICAN MACHINIST, Oct. 23. Hand-Book of Calculation for Engineers, Firemen and Machinists. Price, $2.50, post-paid, or 10 parts, 25 cents. Theo. Audel & Co., 91 Liberty st., New York. Catalogue.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

MANUFACTURES.

The Virginia Car Co. has been incorporated at Buena Vista, Va.

A steel plant will probably be constructed in Clarksville, Tenn.

Cruger & Pace, Albany, Ga., have erected variety works, 70x140 feet.

Moffatt Mfg. Co. (Chester S. C.,) is erecting a $6,000 iron foundry.

E. A. Ebert and others will establish a $175,000 cotton factory at Winston, N. C.

It is reported that big iron works will be located at Christy, Pa., near McKeesport.

The Roane Iron Company at Rockwood, Tenn., is adding new machinery to its plant.

It is reported that an 8,000-spindle cotton factory will be erected at Albertville, Ala.

The Franklin Edge Tool Co. intend to build a hardware factory at Wilmington, Del.

The Newnan (Ga.) Cotton-mill contemplates putting in $10,000 worth of new machinery.

The Valley Machine Co. has been organized at Saginaw, Mich., with a capital of $30,000.

The Alabama Pipe Company has commenced the erection of its pipe works at Bessemer, Ala.

The Lone Star Ice Works, Austin, Tex., will probably establish a foundry and machine shop.

The Eagle Iron Works (St. Louis, Mo.,) contemplate adding more machinery to their plant.

A nail factory is to be erected at Kensington, Ga., by Lilly & Hillsley, of Philadelphia, Pa.

Gilbert & O'Neil have incorporated the Sheffield Iron Works, to operate their plant at Sheffield, Ala.

It is stated that the early construction of a tin-plate-mill at Chattanooga, Tenn., is contemplated.

The Atlas Iron and Brass Works (Kaukauna, Wis.,) will, it is reported, remove to Duluth, Minn.

The Tampa (Fla.) Electric Light & Power Co. will put additional machinery in its electric light plant.

Machine shops will, it is stated, be established in the Maryland Agricultural College at Baltimore, Md.

The Standard Iron Company has been formed at Salem, Va. W. W. Bland, president; capital, $300,000.

The old iron rolling-mill at Roxbury, Conn., is to be torn down and a large grist-mill built on the site.

The Jackson Foundry Association will erect a new building for its iron foundry at Jackson, Tenn.

The Seward Tin Works Company, of Petersburg, Va., is about to establish a tinware factory at that place.

The Rigby Safety Car Wheel Co. is a new organization at Detroit, Mich., with a capital stock of $500,000.

The Bedford Electric Co. is reported as to put new machinery in its electric light plant at Bedford City, Va.

It is reported that the Union Pacific Railway will erect machine shops at Fort Worth, Texas, to cost $1,000,000.

G. E. Wheeler & Co., of Wilmington, Del., have erected a boiler and pipe-covering factory in Piedmont, Ala.

The Goshen Car and Railway Equipment Company, of Goshen, Va., will build a car works plant in that town.

The Hampden Corundum Wheel Company, of Chester, is to remove to Brightwood, near Springfield, Mass.

A stock company will probably be organized at Charlotte, N. C., to establish a foundry and machine shop.

The Wainwright Manufacturing Co. (Boston, Mass.,) has removed its New York office to 121 Liberty street.

E. B. Cornell, of Philadelphia, will erect, at Tampa, Fla., an ice factory and cold storage plant to cost $40,000.

Cheney Brothers, of South Manchester, Conn., are to put $10,000 worth of new machinery into their silk-mill.

T. W. Dowda contemplates establishing a cotton rope factory at Tate, Ga. Necessary machinery will be wanted.

The Henderson Electric Light and Power Co. (Henderson, Ky.,) is being organized, with a capital stock of $50,000.

The Adams & Price Locomotive and Machine Works, at Nashville, Tenn., which was burned recently, will be rebuilt.

The Blacksburgh Machine and Iron Works has been incorporated at Blacksburgh, S. C., with a capital stock of $12,000.

The Coulter & McKenzie Machine Company, of Bridgeport, Conn., are planning to make a large addition to their works.

C. P. Stranyan, of Kankakee, Ill., is reported as negotiating with a view to establishing a knitting-mill in San Antonio, Tex.

The Enterprise Machine Works has put in additional machinery, and will add an iron foundry to its plant at Knoxville, Tenn.

D. R. Wing & Co., Little Rock, Ark., will, it is stated, add to their foundry and machine shops a blacksmith shop 50x100 feet.

It is stated that the works of the Ajax Forge Co., of Chicago, Ill., which were burned some time ago, will be rebuilt on a larger scale.

The Great Northern Iron and Steel Company has been incorporated at Duluth. The amount of capital stock is placed at $2,000,000.

The Utah Mining and Irrigating Pump Mfg. Company, with a capital stock of $150,000, has been incorporated at Salt Lake City, Utah.

The Elberton Electric Light Company, Elberton, Ga., will petition the Legislature for a charter, and probably erect an electric light plant.

The Argonaut Cotton-mill Company (Covington, Ky.,) is reported as erecting its cotton-mill, and is to put in $100,000 worth of machinery.

The contract for the new silk-mill at Catasauqua, Pa., has been given out, and work will be begun at once. The plant will cost over $200,000.

The James P. Montgomery Balance Pump Manufacturing Co. has organized, with a capital stock of $100,000, to do business at Pueblo, Col.

The Atlas Iron and Brass Works is a new institution at Duluth, Minn., that will employ 200 men in operating a plant that will cost $75,000.

A company, with an authorized capital stock of $50,000, is reported as organized at Buchanan, Va., to establish agricultural implement works.

The Broadway Machine Company, of Broadway, will remove, it is reported, its machine shop and foundry to Luray, Va., and double its capacity.

J. L. Whatley and others, Savannah, Ga., are organizing the Mutual Co-operative Association, with $500,000 capital stock, to erect a cotton factory.

The Morse Twist Drill Co. (New Bedford, Mass.,) are about finishing an addition to their plant, 160x36, two stories, with an annex 40x80 of one story.

The Houston & Texas Central Railway Co. (office, Houston, Texas,) will, it is rumored, move its Sulphur Springs machine shops to Waco, Tex.

It is said that the Boston & Maine Railroad has purchased the Swampscot Machine Shop at South Newmarket, N. H., and will utilize it as a repair shop.

At Newport, Ky., a $250,000 stock company is reported as having been organized to erect works for the manufacture of aluminum by a patent process.

The Beedle & Kelly Co., of Muskegon, Mich., has been chartered, for the purpose of manufacturing implements and machinery; capital stock, $100,000.

Augusta, Ga., is endeavoring to secure the location of the gun works to be established near the Gulf and Atlantic coasts by the United States Government.

W. C. Maynard and J. O. Manton, of Northampton, Mass., are investigating, with a view of establishing an agricultural implement factory in Mobile, Ala.

E. M. Ivine, of Grand Haven, Mich., has made a proposition to organize a $50,000 stock company for the removal of his iron works plant to Aberdeen, Miss.

The contract is reported as having been signed for the establishment in Arnold's Valley, near Glasgow, Va., of machine works to manufacture sugar-mill machinery.

The Interocean Boiler Company, capitalized at $100,000, has filed articles of incorporation at Duluth, Minn. The company will manufacture the Hazleton boiler.

The Fort Payne (Ala.) Coal & Iron Co. has purchased the right to use the F. G. Bates steel process in the South, and will construct a plant in Fort Payne, Ala.

The Holmes Tripod Boiler Co., at Duluth, Minn., has been organized, and it will build a plant that will cost over $80,000, and which will give employment to 200 men.

A stock company, recently organized with W. A. Carpenter, president, and John Fitz, general manager, has established a foundry and machine shop in Carnegie City, Va.

The Phoenix Iron Works (Cleveland, Ohio,) are compelled to extend their capacity. They will, in a few days, determine on location, and proceed to erect extensive works.

Tomlin & Harris have increased the capacity of their planing-mill at Cordele, Ga., erected a foundry and machine shop, and organized the Cordele Machine Shop to operate same.

The Florence Wagon Co., of Florence, Ala., is investigating with a view of establishing a branch of its wagon works in Atlanta, Ga., and organizing a stock company to operate same.

The company recently reported as probably to operate the old Rock Island Cotton-mill near Charlotte, N. C., has a capital stock of $40,000, and will put new machinery in the old mill.

The Elliott Frog and Switch Company, East St. Louis, Ill., has purchased two blocks of land in the Aimes tract, on which, it is said, they will erect new and extensive works next spring.

It is stated that the Queen and Crescent route will remove its Ludlow (Ky.) car shops to Chattanooga, Tenn., erect new blacksmith and machine shops, and double the capacity of its roundhouse.

A machine shop and foundry is shortly to be erected at Rockford, Ill., for the manufacture of railway specialties. The main building will be 100x40 feet, two stories high, with solid brick walls.

The Fitchburg Engine Co. (Fitchburg, Mass.,) will move their entire plant to Gardner, Mass., next year at as early a date as a building can be erected for them. When finished, the building will be 170x70 feet.

The Scott Machine and Hardware Manufacturing Company, of Denver, Col., has added to its plant another department for the twisting of metal into odd shapes, which is an entirely new industry in Denver.

The City Manufacturing Company, of New Bedford, Conn., has voted to increase its capital stock from $300,000 to $600,000, and will at once erect a new mill, with a capacity of 30,000 or 40,000 spindles.

It is stated that H. T. Farnsworth, of Richmond, Va., is investigating with a view of establishing in Bristol, Tenn., works for the manufacture of water wheels, pulleys and cars, with compressed air as a motive power.

The Virginia Stove and Range Company at Wytheville, Va., is preparing for the erection of extensive works. The building will be 195x160 feet, and three stories high. The works are to be in operation in three months.

F. B. Lanning, superintendent of the Perseverance Iron Company, Passyunk avenue, Federal and Eneu streets, Philadelphia, writes us that that company will build a foundry plant, putting in the best modern appliances.

R. E. Sanford, of Columbus, Ohio, is reported as having purchased the iron foundry and machine shops of the Laredo Foundry and Machine Co., Laredo, Tex., and will put in $7,000 worth of new machinery, and operate same.

The Railway Automatic Signal Company, Lynchburg, Va., has been organized, with T. N. Davis as president, and T. J. Ingram, secretary, to manufacture Alexander Robertson's railway automatic signal. The capital stock is $100,000.

The Schofield Metal Cross Tie Company, organized to manufacture the Schofield patent metal railroad tie, at Chattanooga, Tenn., intends to increase its capital stock $100,000, in order to build a rolling-mill for the manufacture of ties.

The Locomotive Anti-sand Equipment Company of Chicago, has been incorporated for the manufacture and sale of railroad appliances. The capital is $50,000. The incorporators are Arnold J. Schevers, Thomas R. Freeman, and Henry S. Reynolds.

The Hartsfeld Furnace and Refining Co. has been incorporated in Newport, Ky., with Herman Nagel, president; George Hildebrand, vice-president, and William Lampe, secretary, to smelt and refine precious metals. The capital stock is $10,000.

William D. Troutner, Pittsfield, Ill., informs us that he is ready to fill orders for small Corliss engines, from one-half to two-horse power. These engines are made as ornaments, to run peanut and pop-corn roasters, fans in restaurants and hotels.

S. T. Woodward and others, of New York City, have made a proposition to the Elyton Land Company for the erection of a $400,000 steel plant at Birmingham, Ala. It is stated that the company will probably subscribe $50,000 to secure the enterprise.

The first malleable iron works to be established northwest of Chicago has just been located on Concord street, St. Paul, Minn. A lot 100x120 feet with buildings has been donated. The works will employ at the beginning about twenty-five or thirty hands.

The Virginia Steel, Iron and Slate Company, recently incorporated, proposes to secure the location of woodworking factories, terra-cotta pipe works, iron foundry and machine shop, steel plant and rolling-mill, and other industries, at Logan City, Va.

A party of gentlemen from New York City have been looking over a large tract of land just south of the Little Calumet River, at New Chicago, Ill., with a view to locating woolen-mills there. It is understood that the capital stock of the company is $500,000.

The Buena Vista Steel Company has been incorporated, with C. M. Clark, of Philadelphia, Pa., as president, A. T. Barclay, vice-president, and G. F. Baker, secretary, to construct a steel plant in Buena Vista, Va. The capital stock is to be from $250,000 to $1,000,000.

J. M. Blondell, T. E. Hambleton, W. A. House, Jr., and others, have incorporated the Blondell Manufacturing Co., Baltimore, Md., to erect shops for the manufacture of horse, electric and cable street cars. The capital stock is $200,000.—*Manufacturers' Record.*

The Oswego Machine Screw Co., of Oswego, N. Y., have moved their machinery, etc., to Cortland, N. Y., and will be organized under the name of the Cortland Machine Screw Co. They will employ from twenty to thirty men at the start, and will soon increase their force.

The Virginia Car Co. has been incorporated, with A. S. Buford, of Richmond, as president; F. H. Foster, of Glasgow, vice-president, and Charles Conway, of Richmond, secretary, to build the car works at Buena Vista, Va. The capital stock is to be from $100,000 to $1,000,000.

The Balkana Manufacturing Company, of New York, has been incorporated by the Secretary of State, to make and sell door checks and springs, pneumatic and otherwise, and other hardware specialties; capital, $20,000; trustees, Geo. H. Sweet, Geo. F. Ross and Augusta C. Maas.

Cooke's Safety Switch and Railway Improvement Company has been incorporated at East St. Louis, Ill., by E. J. Crandall, W. L. Parkhurst and G. C. Whitney. The company proposes to manufacture and control the sale of a patent safety switch. The capital stock is placed at $100,000.

The Peninsular Car Works, of Detroit, Mich., will probably be removed to Seattle, Wash. The company is one of the largest in the country, employing over 4,000 men. The matter has not been definitely settled, but depends upon certain tests of the ore in that section, and the quality of the steel made from it.

The Western Locomotive Company has been incorporated in the State of Washington, with a capital stock of $2,500,000 in $2,500 shares. John L. Ayer, Joseph Hadurger and F. D. Burton are incorporators, and the purpose is to locate the principal works at Seattle. The company will manufacture portable engines of all sorts.

The Atkinson Car Spring Works, of Chicago, are building a plant near Harvey, Ill., for the manufacture of steel for their car springs. They are putting in a 12 ton open hearth steel furnace, and a 12-inch train of rolls. The spring works are located in the city at present, but will in the course of time be removed to the vicinity of the steel works.

J. P. Witherow & Co., of Pittsburgh, Pa., are at work on the steel plant being built by the Watts Iron and Steel Syndicate (Limited) of London, Eng., in Middlesborough, Ky. The plant will consist of a complete open-hearth basic steel works, including seven 25-ton furnaces, with all gas producers, blooming-mill, shears, etc.; capacity, 350 tons of slabs and billets per day.

The Sequachee Manufacturing Company has been organized, and is erecting a sewing machine factory at Sequachee, Tenn.; knitting machinery will also be manufactured by the company. The capital stock is $100,000. The Sequachee Agricultural Implement Works also has been organized at that place, and will erect an agricultural implement factory. The capital stock is $100,000.

There is water-works agitation in Stockton, Cal.; Whitestone, L. I.; Forest Grove, Ore.; Saginaw, Mich.; Arkadelphia, Ark.; Cranford, N. J.; Griffin, Ga.; Westchester, N. Y.; Quincy, Ill.; Canton, S. D.; Coal Creek, Col.; Lisbon Falls, Me.; Rochester, N. Y.; Misbawaka, Ind.; Rockford, Iowa; Sorrento, Me.; Fort Smith, Ark.; Westboro, Mass.; Jasper, Tenn.; Knoxville, Tenn.; Waterbury, Conn.

We learn that the demand for Tobin bronze metal, manufactured by the Ansonia Brass and Copper Company, of New York, is constantly increasing, so much so that it has become necessary to enlarge their present very extensive plant at Ansonia, Conn. The principal uses that this metal is being put to are condenser plates, pump linings, pump piston rods, and bolts for various purposes in connection with condensers and pumps, where a non-corrosive metal is required.

The Sebastian-May Co. (Cincinnati, Ohio), manufacturers of lathes, announce that they have built new shops, and will be at Sidney, Ohio, after December 1. The removal has been rendered necessary by rapidly increasing business. The new shops are of brick and stone, and specially arranged for the business of the firm. They are on the lines of two railroads, affording excellent facilities for shipping. This company has been obliged to increase its facilities three times in seven years.

The W. Dewees Wood Company, of McKeesport, Pa., manufacturers of patent planished sheet-iron and steel, have broken ground for the erection of a new mill. The building will be 100x150 feet, and will contain four sheet-mills with all the necessary furnaces and other appliances. It will be built on a piece of ground that has been owned by the firm for several years, and has not been recently purchased, as has been reported. The new addition will be completed and put in operation as early next year as possible, and will give the firm an output of from 18,000 to 20,000 tons of sheet-iron and sheet-steel per year.

The Straight Line Engine Company, of Syracuse, N. Y., has issued a neat little pamphlet containing a complete list of all parties who are using Straight Line engines. The name, post-office address, size of engine or engines used, and the purpose for which they are used, are given in each case, and it must be conceded that the list makes a very favorable showing for the engine and its builder. A large proportion of the engines are shown to be in service for electric lighting, which is considered to be hard service for an engine. These engines are now to be found in ten different foreign countries—twenty-three of them in Japan. In the Mikado palace six of them are used for electric lighting.

A company known as the United States Cold Rolling Wire Company has purchased about 1,000 acres in the vicinity of Hammond, Ind. Machinery to cost $150,000 is now about completed in Pittsburgh, and will be shipped there next month. The company will give employment to 500 men, and will turn out about 500 tons of wire every day. No furnaces will be used, but the wire will be formed from the cold bar of steel. The stock of the concern is placed at $1,000,000. T. B. Bryan, the Jennings Trust Company and Frank Wells are among the principal stockholders. About 4,000 acres are under contract to other manufacturers in the same vicinity. Pratt Brothers, with McElroy, Keeney & Co., since the movement in this vicinity began, have sold $250,000 worth of property.

Some time ago, during our discussion of the merits of the Swinerton driving wheel, we said that further tests were to be made of the wheel, and we should say nothing further about it until those were completed. They have recently been completed on the elevated roads of this city, and nothing was accomplished by the wheels to show that they possessed any merit whatever over the ordinary wheels. Mr. Swinerton informs us, however, that he does not consider these conclusive, for reasons which it is unnecessary for us to relate, but principal among which is the fact that no one interested in the wheel was present when the tests were made. Other tests, he says, will soon be made, which will show just what the wheel will do, and we shall await the result of them.

A correspondent has to make a taper hole in the end of a large number of 1″ square bars of machinery steel. The taper is to be to the Morse standard, 2″ deep and $\frac{11}{16}$″ diameter at the large end. The ends, of 1″ square bars of the best tool steel, are to be provided with taper shanks to fit these holes and all the pieces of a kind must be alike. He wishes us to ask our readers for some rapid way of doing the work.

President X. M. T. R. R. (haughtily)—"Who is this James W. Bungstarter who wants a pass?" Private Secretary—"Great capitalist of Sheboygan—president of the Knocash Natural Sand Bank—lessee of the ——" President (hastily)—"Send him an annual. I thought he was some poor devil who couldn't pay his way."—*West Shore.*

A New Lathe Dog.

The illustrations presented herewith are of a new lathe dog, which, as will be perceived, differs radically from the ordinary dog in being made in two parts which lock together, as shown, leaving the opening in the dog proportioned to the size of the work. By this means a few dogs are made to answer for a wide range of sizes of work, three sizes being made for work ¼" to 3¼" diameter. Another important advantage gained by this dog is that it can be put on or removed from the work after it is in place in the lathe, or can be put between two collars, where it would be necessary in using the ordinary dog to select one much too large for the shaft, and then perhaps pack up to fill the space. These dogs are made of steel, and have steel set-screws. They are introduced by Palmer, Cunningham & Co., 607 Market street, Philadelphia.

The Improved "Victor" Scroll Saw.

We illustrate herewith an improved scroll saw, which is intended to be run by either foot or power, made by the Seneca Falls Machine Co., Seneca Falls, N. Y. Two treadles are provided, so that, when sitting, both may be used, or, standing, one of them. It will cut stock up to three inches in thickness, and has 24" swing. The tension on the saw blade may be readily varied to suit the operator; there is a blower which keeps the line free of sawdust, and the table, which is 18" diameter, turned true and finished, can be tilted to any angle for sawing inlaid work. The drill spindle—which is adjustable for height—is provided with a chuck which will hold drills from No. 60 to $\frac{3}{16}$" diameter. The driving wheel is heavy—24" diameter—and the belt being V-shaped there is no trouble from slipping. The ordinary rate of speed by foot power is about 800 strokes per minute, and should be about the same for steam power—not to exceed 900. It is arranged to use eight inch saw blades regularly, but five inch blades can be used when desired for very light work. Where the machine is to be used by power, tight and loose pulleys are furnished, arranged to connect with the driving wheel shaft. The table is forty inches from the floor, and the machine weighs complete 230 pounds.

"Compound Locomotives."

We publish on another page a communication from a well-known and expert engineer, controverting, in a degree, an editorial on compound locomotives that appeared in our issue of Nov. 13. We are always pleased to publish such communications, believing that good is sure to come through the honest expressions of differences in belief.

Our correspondent takes exception to the expression that—we have a right to quote it verbatim, which we do—"It is a fact well known to engineers that, in most instances, economy comes directly from the use of higher steam pressure."

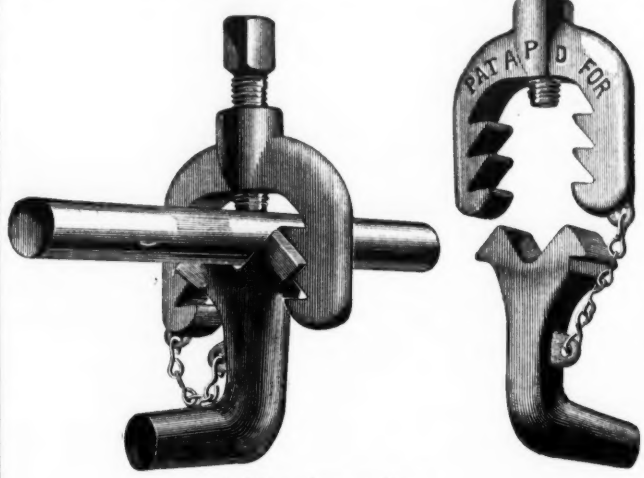
On June 25, 1881, the writer, having at that time no connection with the AMERICAN MACHINIST other than that of an occasional contributor, wrote:

In reference to one-quarter stroke being the most economical point of cut-off, there are a great many, besides the writer referred to, who believe there is no economy in cutting off any earlier in the stroke than that point; but the bare statement of the fact without explanation is misleading; perhaps not to engineers, but it is to many who have an interest in such matters. It should be qualified by saying that, at ordinary pressures, where an earlier cut-off is brought about by the use of steam of higher pressure, there is always, or generally, a gain. It wouldn't be correct to say this gain resulted from an earlier cut-off. It results from the use of steam of higher pressure. To make this clearer: In an automatic engine, working under boiler pressure of, say, 50 pounds, and loaded so as to cut off at one-quarter stroke, corresponding to a terminal pressure of about 16 pounds absolute, which is quite too low for a non-condensing engine; if the load remains the same, and the boiler pressure be increased to 70, the cut-off will adjust itself to cut off materially shorter, which may be taken as a loss; the terminal pressure will fall below the atmosphere—another loss, and yet the general result will be a material gain.

* * * * * * * *

This increased pressure results in better economy, but not because it admits of further expansion. It does it in spite of too much expansion.

At that time he was not—and is not now—aware that any one had called direct attention to this, but the fact had been brought home to him by actual experiments.



A NEW LATHE DOG.

In 1877, Mr. Charles T. Porter (see Transactions American Society Mechanical Engineers, Vol. VIII, page 484,) says:

In non-condensing engines, with ordinary pressures, there is no gain made in economy by cutting off earlier than one-quarter of the stroke. In this class of engines we are absolutely limited to this expansion. If we cut off earlier than this, we merely reduce the power, and so the value of our engine, with a loss instead of a gain in economy.

It is true that if the pressure be raised, as from sixty pounds to one hundred pounds, and so the steam be cut off earlier to do the same work, the consumption [of steam] will be reduced. *This is owing to the higher pressure.* [Italics ours.]

This, we believe, is what will occur if all conditions are favorable. Under unfavorable conditions the gain from the increased pressure may be neutralized, or worse than neutralized. But we have never seen this gain neutralized in ordinary practice.

In regard to the action of the valves, our correspondent will admit that there are link gears and link gears; it may be possible to design one in which a pressure of fifty pounds would give the most economical results, but it does not follow that it is necessary to do so. Similarly it may be said that an engine may be designed, in which distortion of parts will cause such an amount of friction as to make the use of high-pressure steam inadvisable, but it does not follow that such designs are necessary.

Regarding the use of high-pressure compelling the exhausting of steam containing more heat, we cannot see it that way. Suppose we are to do work requiring a mean effective pressure in the cylinder of 80 pounds. Now the higher the steam pressure is carried, the earlier the cut-off, and the less the terminal pressure, hence the less the heat that goes to waste, unless there are conditions that ought not to be present.

To put it another way, the possibilities of expansion by the use of high steam are enormous, and have by no means been reached in the instance of the locomotive engine, in our opinion. Higher grades of expansion mean the employment of higher steam pressure, and the employment of more approved means of using this higher pressure. It is well known that higher grade of expansion can be profitably employed with higher steam pressure, and that for equal work—compared with lower pressure—the terminal pressure will be less.

The idea of our correspondent appears to be that more work must be done because the pressure is raised. This by no means necessarily follows. A saving by the use of high-pressure steam, in the instance of a locomotive, may be brought about in two ways—one by increasing expansion; the other by decreasing condensation by throttling.

Regarding actual scientific tests in locomotive practice, they are extremely rare, owing, as has previously been mentioned, to the difficulties in the way of making them. But we have seen the pressure go up from 125 to—in some instances—200 pounds in the locomotive, and are loath to believe that this increase has been made by so level-headed men as master mechanics without substantial evidence of positive gain. Of course this absolutely proves nothing, but it makes excellent circumstantial evidence, and circumstantial evidence is the most that we can get in many mechanical matters.

So far as gain by the use of higher pressure in stationary engines goes, no doubt a limit could be found, that is, a point beyond which to go would entail loss. But this limit is a long way outside anything reached in locomotive practice.

VICTOR SCROLL SAW.

In response to the general demand for increased mail facilities, the government is about to establish another fast mail train between New York and Chicago via the New York Central and Lake Shore Railroads, the service to commence November 30. The new train will leave the Grand Central station every day in the year at 9.10 A. M., arriving at Albany at 12.28 P. M., where it will receive the great through mails from Boston and New England. It will also deliver and receive mails at Utica, Syracuse, Rochester, Batavia, arriving at Buffalo at 8.10 P. M., where the train will be delivered to the Lake Shore, and will reach Chicago at 9.30 A. M., making almost as quick time as the Central's limited. With the adoption of the new service, it will be possible for letters written in New York and New England one morning to be read by correspondents in Chicago before 10.30 the next morning. Business men will appreciate the importance of this move.—*Commercial Advertiser.*

Trial Trips of the New Gun Boat "Concord."

The trial trips of the new gun boat "Concord" commenced on the 18th inst., and ended on the 19th inst. The results of these trials seem to show that she will be the fastest gun boat yet built for the navy; and had it not been for a few trifling mishaps, which are liable to occur to any kind of new machinery subjected to the severest test, the question as to her speed would have been settled beyond a doubt. During the commencement of the trial on the first day, it soon became apparent that something was wrong with the steering apparatus, as the ship failed to answer her helm. An examination showed that the proper connections of the steering gear, which should have been made, had been accidentally overlooked. In the meantime the "Concord," slowed to a moderate speed, had been steered up the river, and through Hell Gate, without having the use of the rudder, merely using the twin screws as a means of steering. Of course, under these conditions, great care and skill was required in handling the vessel, as she steamed several miles through the crowded river where currents are swift and variable, as is the case in East River and Hell Gate. The trip up the river, however, was successfully made, which speaks well for the steering capabilities of the vessel, and may be considered to be a feat seldom, if ever, performed. After passing Hell Gate, the speed of the vessel was increased; and when off College Point the vessel was stopped for fifteen minutes while the steering gear was being connected. Afterwards the vessel was started ahead full speed, and ran out into the sound a distance of about four miles. No official record was kept, but several experts estimated the speed to be 17 knots, although a higher speed was obtained on the second day. Having tested the steering engines by making a short run in the sound, the "Concord" returned to City Island, and anchored for the night.

On the second day a trial trip of four hours' duration was commenced, and the vessel put to as severe a test as she is likely to be ever subjected to in service, except in time of battle.

At the beginning of every fifteen minutes, indicator cards were taken by the different members of the Board of Engineers appointed by the government. In the last five minutes of each quarter hour, the engineer officers of the contractors were at liberty to make such alteration as were deemed necessary. No changes were permitted in the first ten minutes of each quarter. The taking of the cards continued throughout the test, and from the average of these cards the horse-power will be computed. The steam pressure ranged from 150 to 160 pounds, and the number of revolutions ranged from 148 to 153½ per minute. The speed was estimated at 17.8 knots per hour. The engines worked to a charm, but a slight leak in one of the boilers prevented a satisfactory conclusion of this trial. After the horse-power test, the maneuvering qualities were examined. When going at full speed ahead from the time of ordering "back, full speed," headway was lost in one minute and 17 seconds. A turn of 360 degrees under starboard helm, both propellers working ahead, was made in 5 minutes and 20 seconds. The same turn under port helm occupied 5 minutes and 21 seconds. Going ahead full speed on the starboard engine, and backing on the port engine, a turn of 360 degrees was made in 7 minutes and 36 seconds. The reverse turn was made in 7 minutes and 28 seconds.

The length of the "Concord" is 230 feet on the water line; extreme breadth, 37 feet;

mean draught, 14 feet; displacement, 1,700 tons. The engine is of the horizontal triple-expansion type; cylinders, 22, 31, 50 inches diameter; stroke, 30 inches. Diameter of propeller, 10 feet 6 inches; pitch, 13 feet 3 inches. The engines were built by the Quintard Iron Works, New York.

The Water Supply in Kansas.

There has been growing upon those who have studied the plains of Western Kansas the conviction that the success of agriculture in the western third of the State is beyond question a failure unless a more permanent water supply can be obtained. A new theory has been broached, that of irrigation by means of the "underflow" in the river valleys, and it has been tested with remarkable success. In searching for and investigating the water sources, it was discovered that underneath the great valley of the Arkansas, and presumably under all the river valleys of Western Kansas, if not under the plains, lies hidden a vast body of water. The possibility of utilizing this as a source from which to supply the ditches naturally arose, and practical tests have just been completed that prove the entire reasonableness of the theory.

The vicinity of Dodge City, about 100 miles from the western line of the State in the Arkansas Valley, was selected as the place for the experiment just completed. There was opened a ditch fourteen feet wide, and drifting westward up the valley. The river falls seven feet to the mile, and the ditch was commenced three feet below the surface, and extended westward on a grade of three feet to the mile, which soon brought it below the level of the river bottom.

The ditch was extended until the excavation was found to be twelve feet deep, and six feet below the river bottom. Into the ditch thus dug into the solid earth drained the underflow. So great was the drainage that at the point of beginning a dam was constructed, and the amount of water flowing over it was found to be thirty cubic feet per second.

A ditch was opened easterly along the higher land at a fall of only 1 7-10 feet per mile, so that by the time the ditch reaches a point southeast of Dodge City there is a perpendicular fall possibly of nearly or quite twenty feet, with a water supply as constant as the everlasting hills, or at least so considered.

The ditch thus far constructed, and which it is believed will furnish a permanent supply the year round, as it was completed at the close of the driest season ever known in Western Kansas, will irrigate about 25,000 acres of land, and has been built at a cost of $60,000. The proprietors believe that with their experience they could now do the same amount of work for at least $10,000 less.—*Chicago Herald.*

It would not matter much if the little amusements they have on Wall street had no effect outside that sacred locality. In fact, the world outside might find amusement in the orgies of the street but for the fact that these orgies affect outside matters seriously. For example, the recent trouble on Wall street has caused a run on saving banks by workingmen depositors, that has cost them many a hard-earned dollar. It is useless to say that these runs on banks by small depositors are in the main senseless. They are inspired by a distrust that comes from the belief that their deposits are being speculated with, and that there is really no assured safety in the average savings bank, so long as this is true. This distrust is in the main wrong, and, on the whole, savings banks are fairly safe; but the fact that they have been wrecked by speculative efforts leads to lack of confidence in any but the few that are well known and tried.

There is a very sensible intention on the part of the citizens of many towns to establish electric car lines. It beats horse propulsion by big odds. But it is better to delay good things by a little interval of time, rather than allow them to come with known frailties. Therefore, it is better to delay the introduction of electric cars than to permit them to come with the constant menace of overhead wires. In any city that permits this, a mistake is made that will sooner or later be recognized. Make things safe in the first place, then go ahead.

Messrs. Watson & Stillman, of this city write us:

We notice in the copy of paper just in to-day, replying to inquiry No. 440, you say that it is not possible to draw the temper of mushet steel in any way. We would beg to differ with you in that statement. Some year and a half ago we had sent to us a piece of mushet steel which was treated by a black, smith of this city in such a way that it was rendered very easily cut; so much so, that we were able, with ordinary tools, and at ordinary speeds, to make a twist drill from it, without injuring our cutters. It was then re-treated so that the original temper was given to it. The method of treating this is a secret, we believe, with the man doing it.

J. J. Flather writes us:

In your issue of Nov. 13th, in article on Measurement of Power (first column, sixth page,) the text should read as follows: Although we can calculate what the width of a belt *ought* to be to transmit a given horse-power x at a given velocity, the stress in the belt may be greater or less than that on which our formula is based, and the resulting horse-power transmitted may be $x +$ or $- y$; not "$x + y$" as given.

Machinists' Supplies and Iron.

NEW YORK, Nov. 22, 1890.

Iron—American Pig—The somewhat unsettled condition of financial affairs and uncertainty as to what may happen has had some effect upon the iron trade, though quotations for standard brands remain unchanged, concessions being obtained upon the less known products only.

We quote No. 1 Foundry, standard Northern brands, $17 to $18; No. 2, $16 to $16.50; Gray Forge, $15 to $15.50; Southern brands, No. 1 Foundry, $16 50 to $17; No. 2, $15.75 to $16.

Scotch Pig—The market has ruled dull, and only small sales have been made.

We quote Coltness, $24.50; Dalmellington, $22 to $22.50, and Eglinton, $20.50.

Lead—The market has ruled dull and weak, consumers showing little disposition to buy beyond immediate wants. Prices are at about 4.75c. to 4.85c.

Spelter—There has been no change of note, and sales have been small.

We quote ordinary brands of Western at 6c. to 6⅛c.; choice, 6⅛c. to 6¼c.; refined, 7¾c. to 8c.; Silesian, 7⅝c. to 7⅞c.

Tin—The financial situation in London has had some effect upon the market there, and the market here is dull and weak. Prices are at 2.15c. to 2.30c.

Antimony—The demand for Regulus has been moderate.

We quote Hallett's, 17¾c.; Cookson's, 19⅞c.

Copper—The market has ruled dull and quiet, the Lake companies asking 17 cents, but outside parties continuing to sell at somewhat lower figures.

We quote casting brands 14c. to 14¼c.; Arizona. 15c. to 15¼c.

Lard Oil—The market is steady, and prices maintained at 50½c. to 51c. for Prime.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

¶Wanted—Pattern makers, machinists and molders. Inquire, Dustin-Hubbard Mfg. Co., Fort Payne, Ala.

A live young man, with experience in foundry and machine shop, desires situation as shipping clerk; good references. S. C., AM. MACHINIST.

Wanted—An experienced mechanical draftsman on steam engine work; location, Eastern Pennsylvania. Address BOX 8, AMERICAN MACHINIST.

Wanted—Mechanical draftsman Address, stating experience, and wages expected, J. R.Clay, care Smith & Valle Co., Dayton, Ohio.

Wanted—Position as foreman in machine shop or mfg. concern: exp'd on fine automatic machinery, tools and general work. Practical, AM. MACH.

Situation wanted by mech. draftsman, mathematician, and practical, thorough machinist; city New York or Brooklyn. Mech. Draftsman, AM. MACH.

Machinists Wanted—First-class floor hands and fitters of large experience and of good habits can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, O.

Wanted—A few first-class tool makers, machinists and drop forgers; applicants to state class of work accustomed to, and where they have worked. Address BOX 7, AMERICAN MACHINIST.

Wanted—A position as draftsman, by a young man with technical education and four years' practical experience; can give references. Address M. E., AMERICAN MACHINIST.

Salesman, who can handle a line of high grade automatic engines, from 5 to 40 H. P., on commission; also, agents wanted in the different cities. Address BOX 9, AMERICAN MACHINIST.

Wanted—One draftsman and three men for reading drawings and transferring dimensions to castings. Must have had experience or have graduated from technological institute. The Deane Steam Pump Co., Holyoke, Mass.

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BEST HAMMERS IN THE WORLD RUN BY BELT

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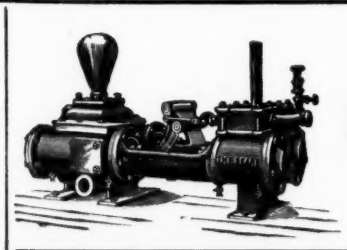

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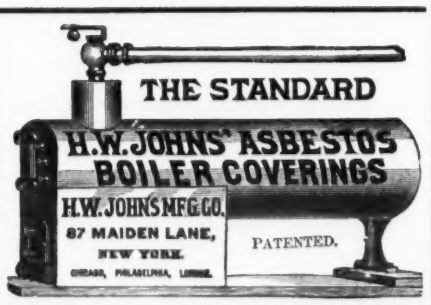

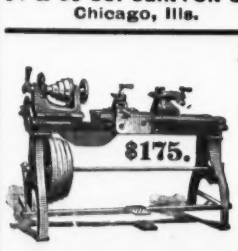

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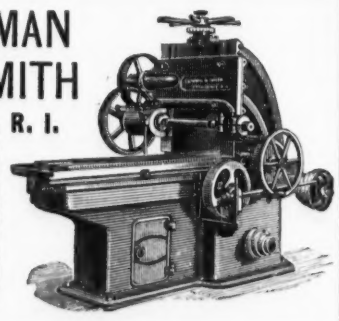

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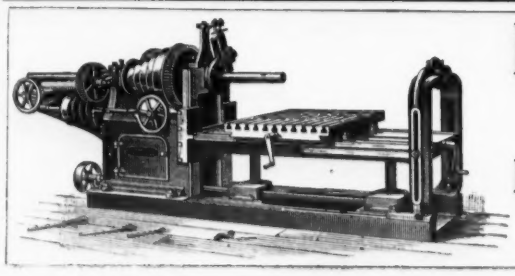

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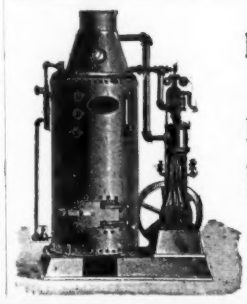

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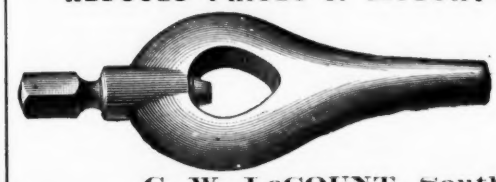

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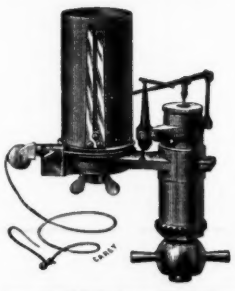

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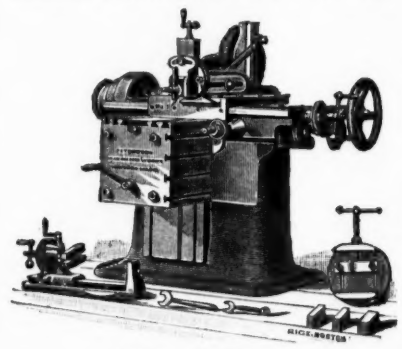

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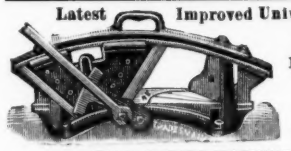

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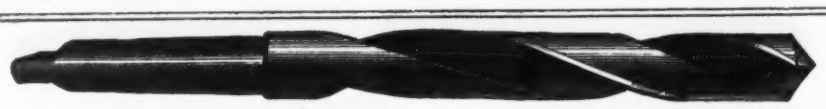

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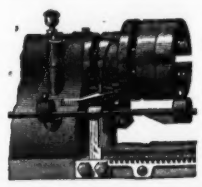

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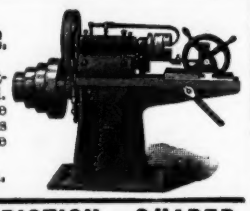

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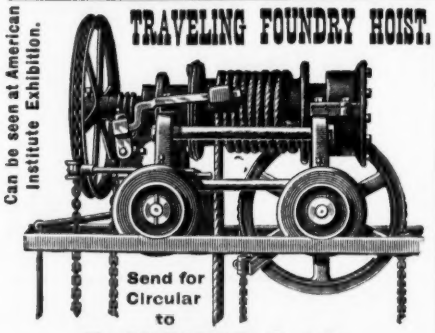

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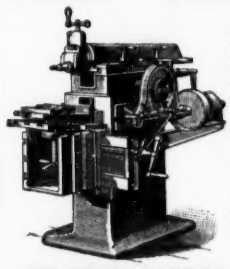

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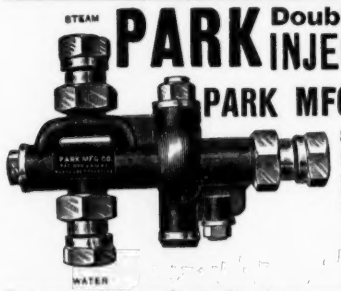

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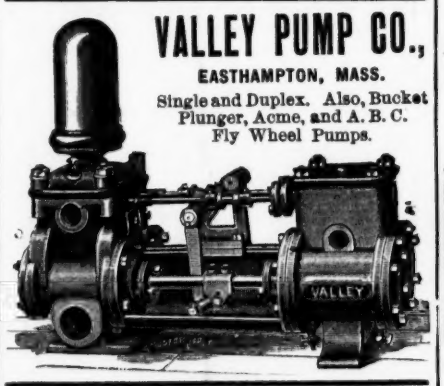

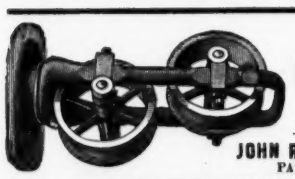

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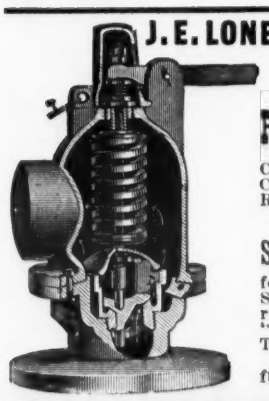

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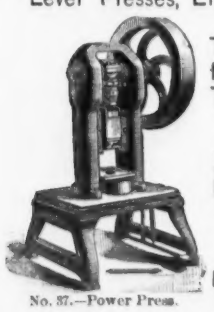

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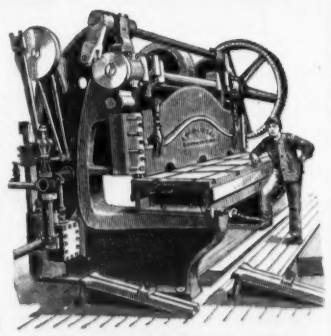

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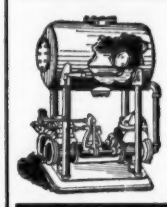

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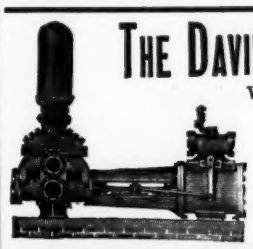

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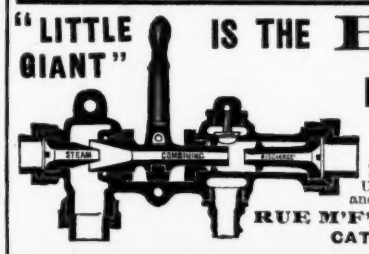

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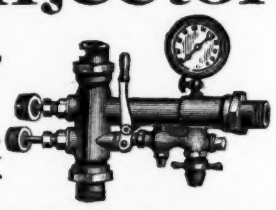

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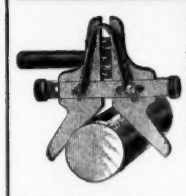

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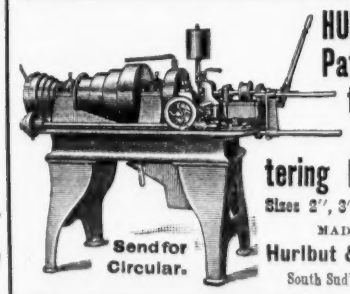

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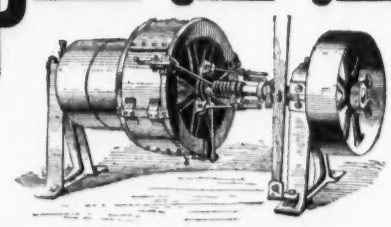

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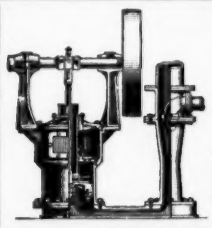

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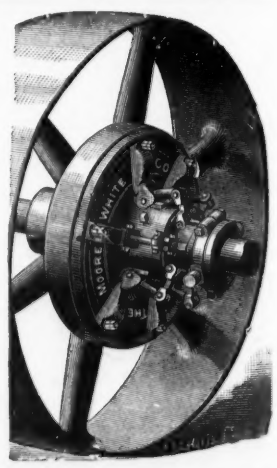

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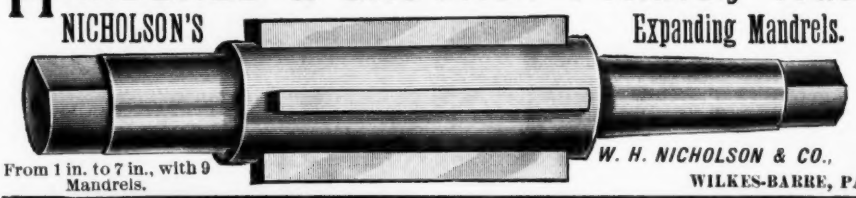

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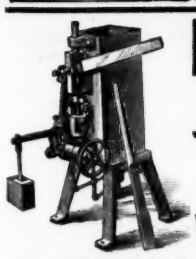

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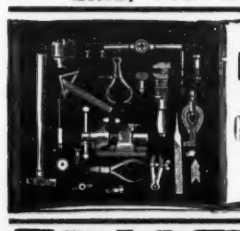

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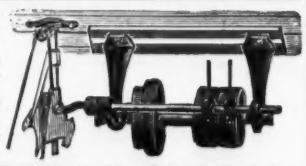

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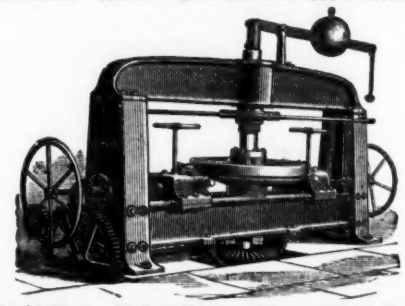

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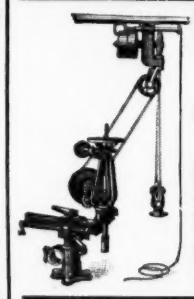

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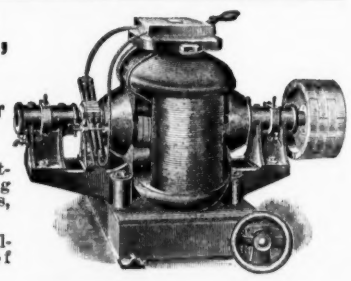

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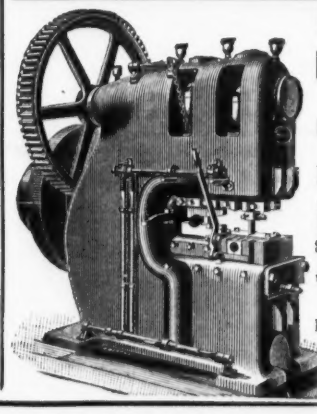

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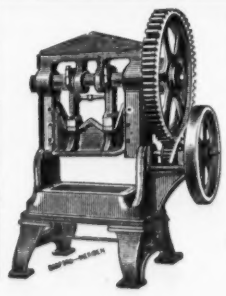

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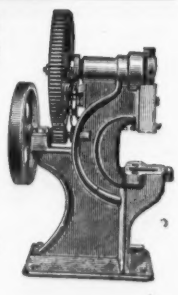

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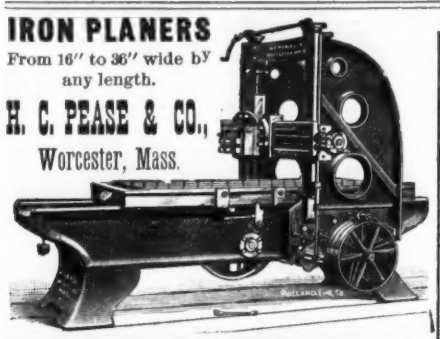

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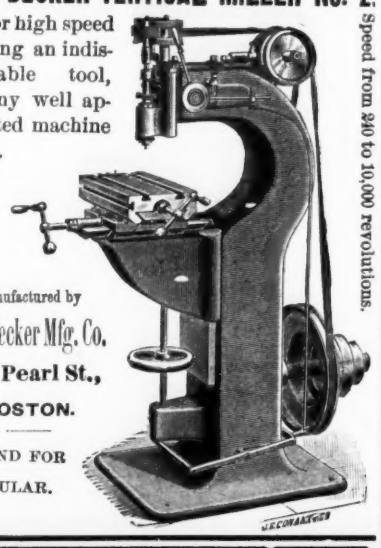

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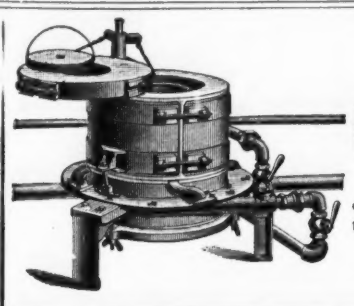

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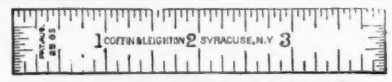

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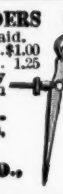

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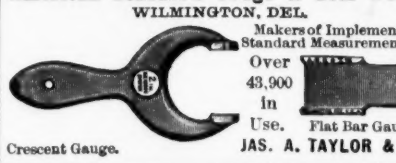

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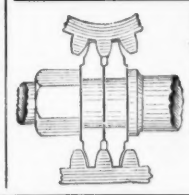

For cutting the teeth of gears; one Duplex Cutter cuts a pitch from 15 teeth to a rack inclusive.

I will send one pair of these Cutters on 30 days' trial to responsible parties. Kept in stock.

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☞ Are you boring on Engine Lathes?

☞ Then you are losing money!!!

☞ Enough work bored on these machines to keep 20 Engine Lathes running.

☞ Automatic Revolving Turret.
☞ Automatic Feed to Turret.
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☞ Large Hollow Spindle, 1¾ hole.
☞ Extra Large Bearings.
☞ Combination Chuck with each machine.

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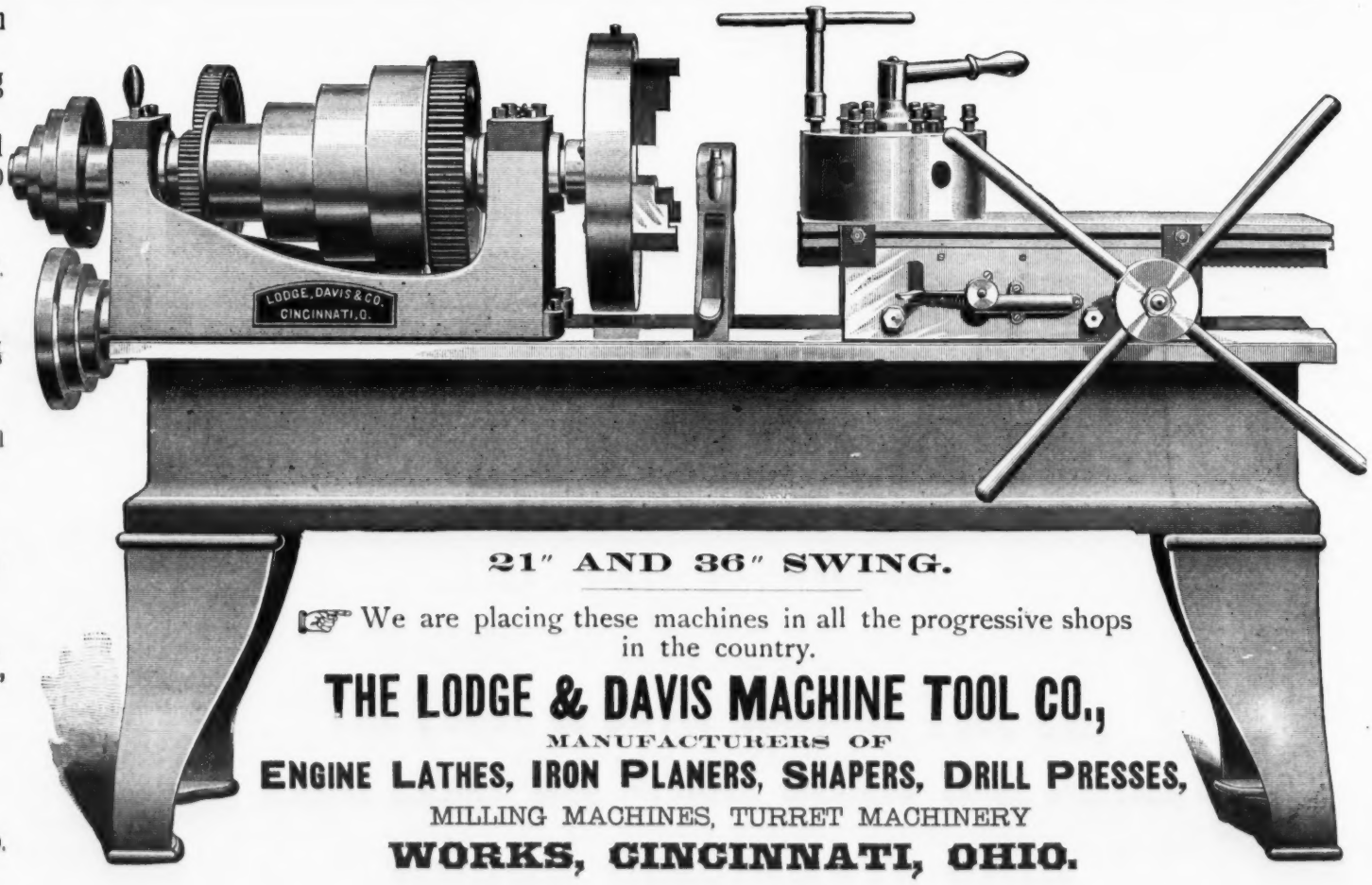

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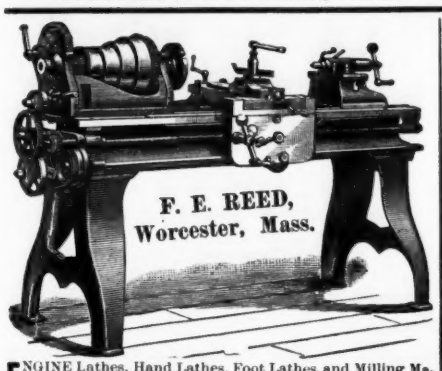

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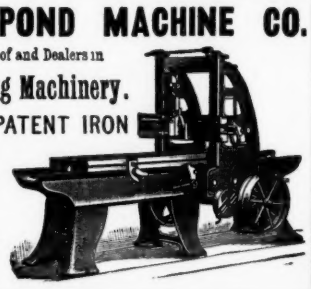

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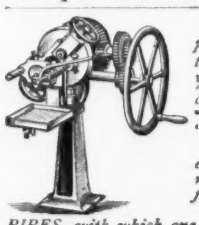

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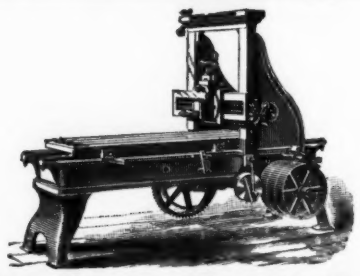

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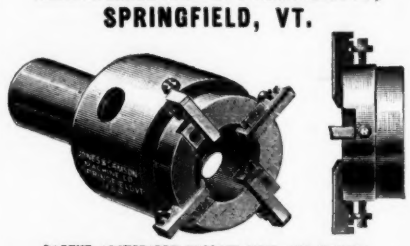

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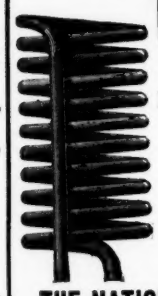

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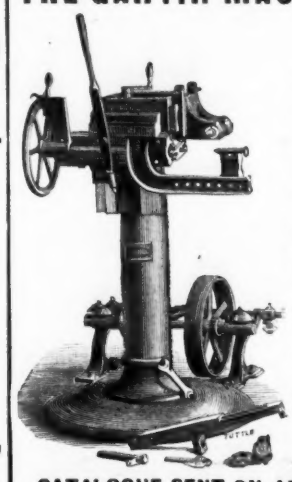

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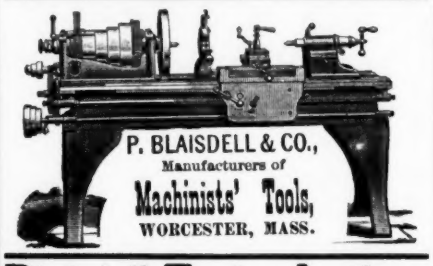

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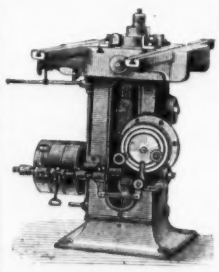

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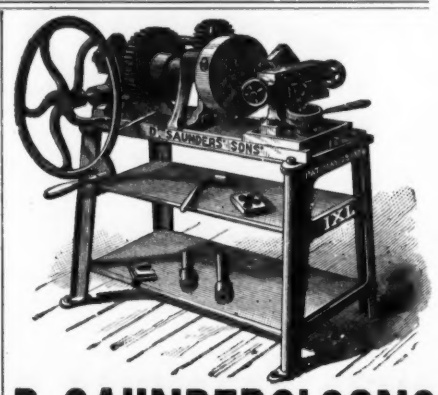

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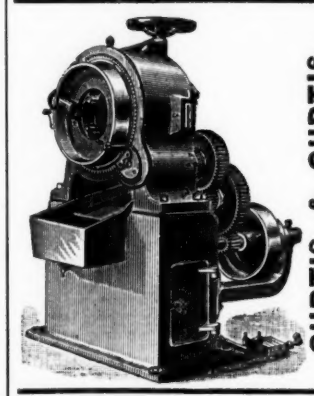

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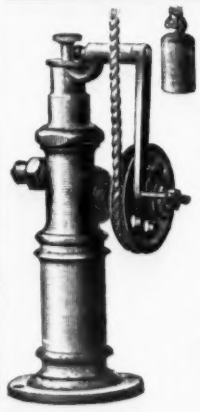

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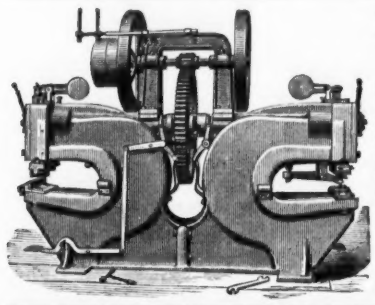

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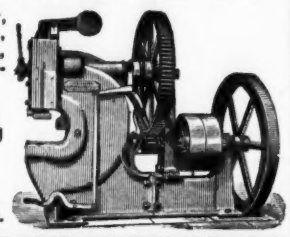

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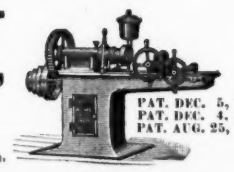
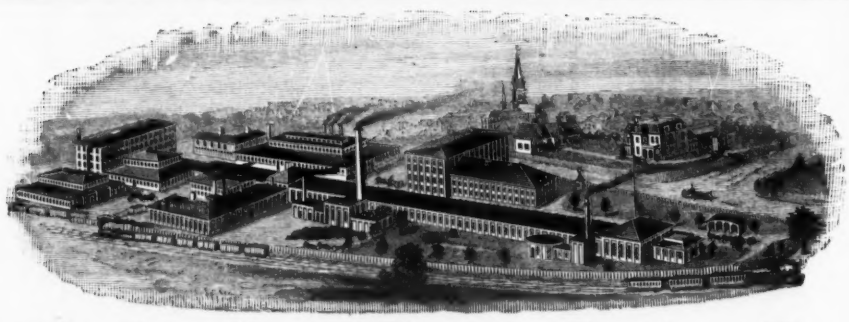


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.



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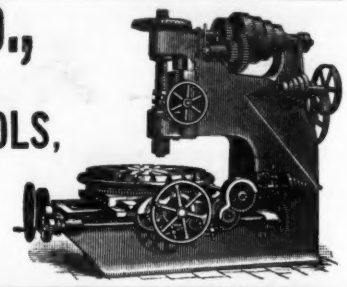

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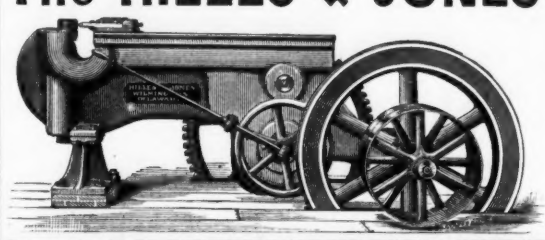

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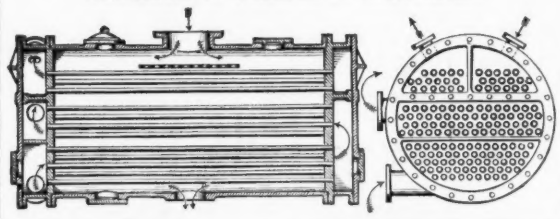

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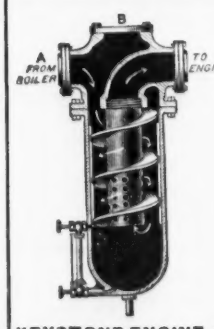

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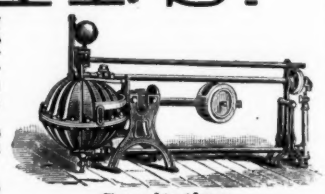

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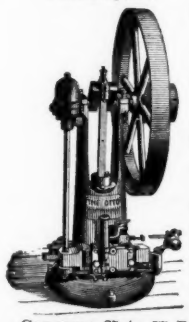

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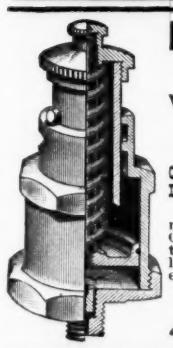

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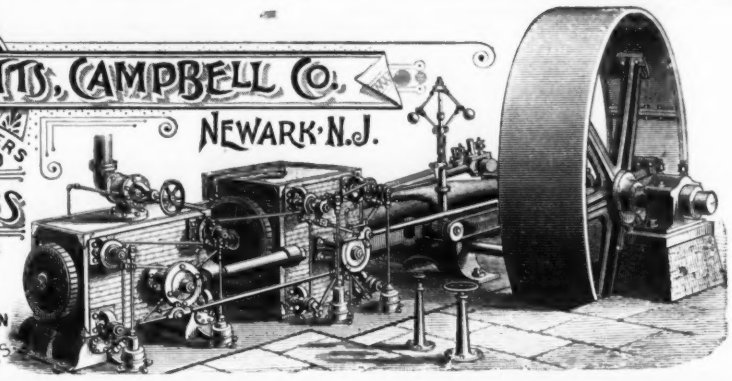

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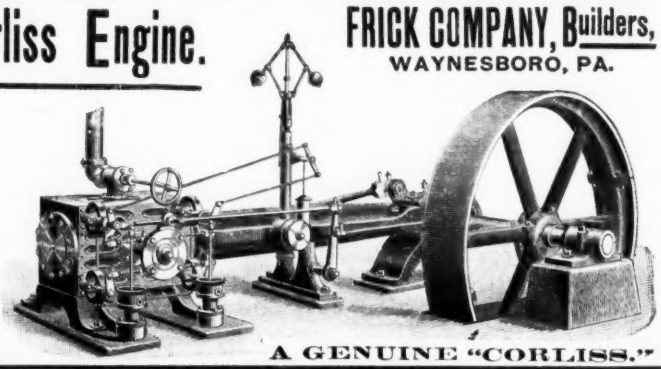

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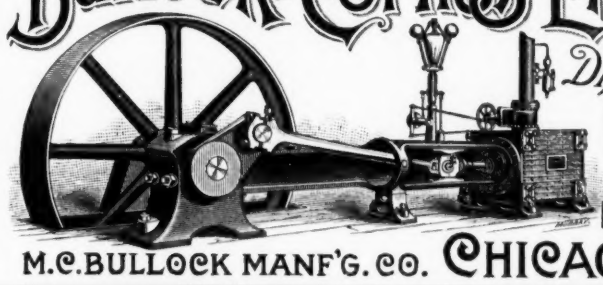

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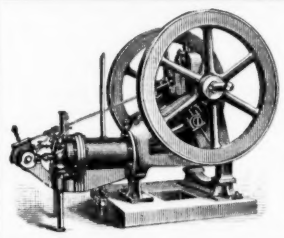

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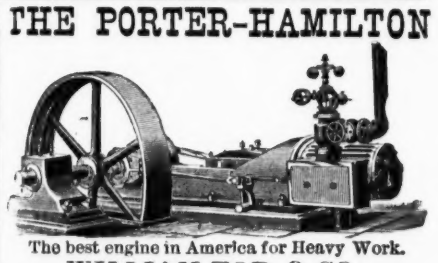

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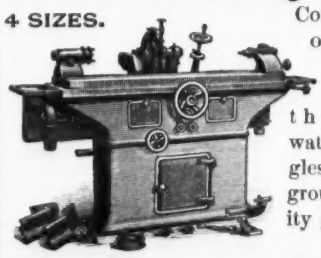

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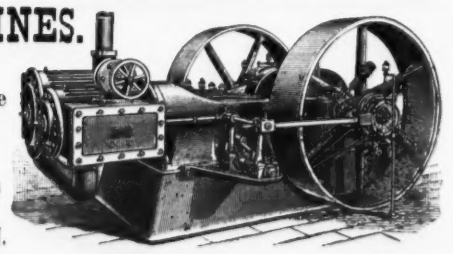

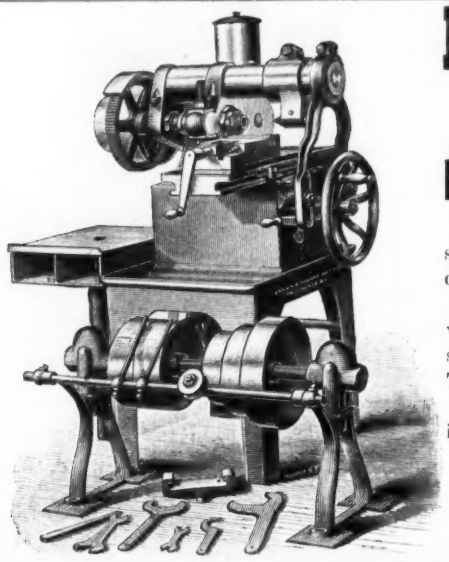

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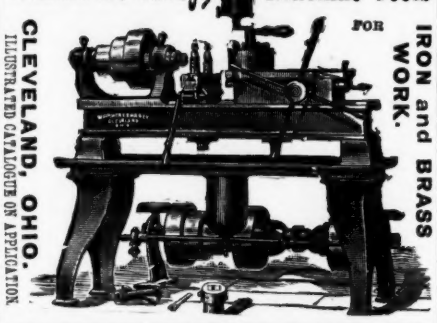

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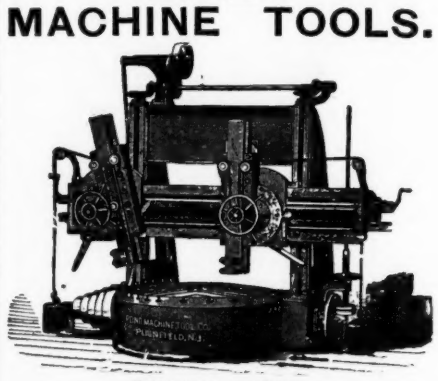

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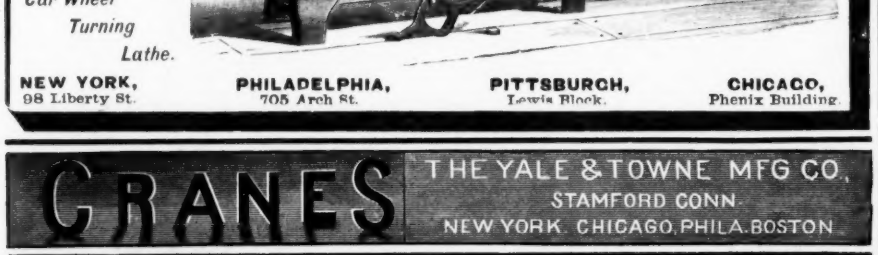

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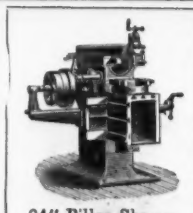

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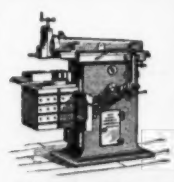

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